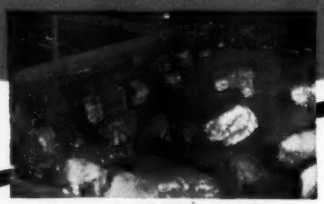
Mining

CONGRESS JOURNAL

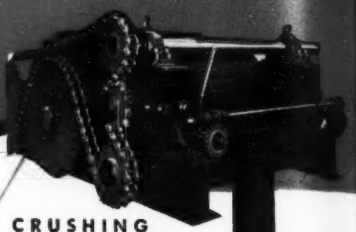
FEBRUARY
1947

LINK-BELT OFFERS YOU MANY YEARS OF SPECIALIZED EXPERIENCE IN COAL PREPARATION

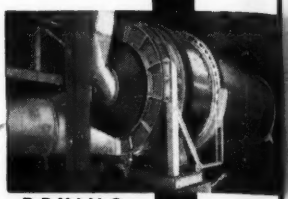


SCREENING

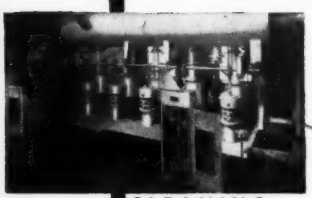
PICKING



CRUSHING



DRYING



CLEANING

LOADING

BLENDING & MIXING

CONVEYING

STORING

DUMPING

ALMOST from its inception, over 70 years ago, Link-Belt Company has devoted a large portion of its engineering and manufacturing business to the handling and preparation of coal.

The first successful coal washeries in the United States were built by Link-Belt in the early nineties, and since that time Link-Belt has developed and manufactured washing jigs and related equipment on an ever increasing scale.

Mechanization in handling and preparation is the only answer today to the low-cost production of quality coal.

Link-Belt designs, builds, installs and services. Link-Belt offers you broad experience, proved performance and centralized reliable responsibility. Discuss your mechanization plans wtih us.

LINK-BELT COMPANY Chicago 9, Philadelphia 40, Pittsburgh 19, Wilkes-Barre, Huntington, W. Va., Denver 2, Kansas City 6, Mo., Cleveland 13, Indianapolis 6, Detroit 4, St. Louis 1, Seattle 4, Toronto 8.

10,625

COAL PREPARATION AND HANDLING EQUIPMENT

Engineered, Built and Backed by LINK-BELT

Mining CONGRESS JOURNAL

Contents

VOLUME 33 · NUMBER 2 · FOR FEBRUARY, 1947

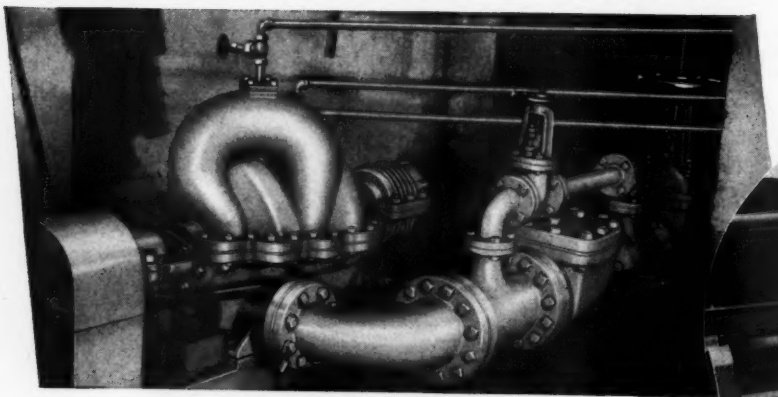
★ ★ ★

Opinions expressed by authors within these pages are their own, and do not necessarily represent those of the American Mining Congress

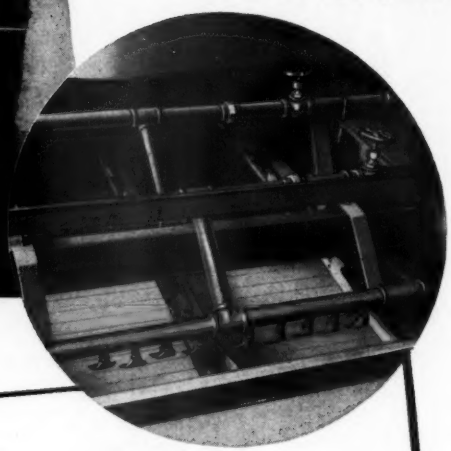
THE AMERICAN MINING CONGRESS
309 MUNSEY BLDG., WASHINGTON 4, D. C.

Subscription Rates: United States and South America, $3.00. Foreign, $3.00. Single copies, $0.50. February Annual Review Issue, $1.00. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

ABC



FOR DRAINAGE SYSTEMS, *Crane supplies all piping equipment—valves, fittings, and pipe—brass, iron, or steel.*



VIBRATING SCREENS *equipped 100% with Crane quality piping materials.*

CRANE . . .

best-known name in Mine Piping

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

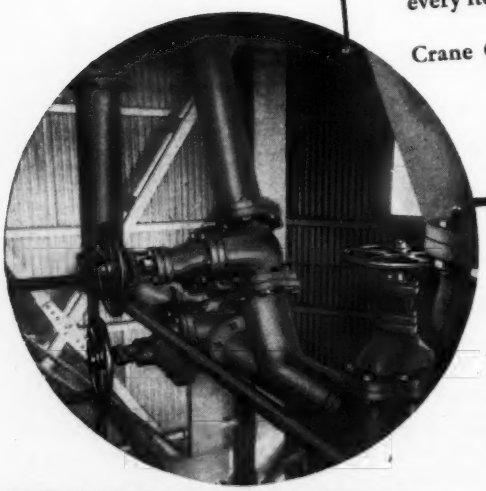
3 REASONS WHY!

MOST COMPLETE LINE—The completeness of the Crane line—in brass, iron, and steel materials—simplifies buying and specifying for all mining services—above and below ground. One order to the nearby Crane Branch or Wholesaler gets everything: valves, fittings, pipe, accessories, and fabricated piping.

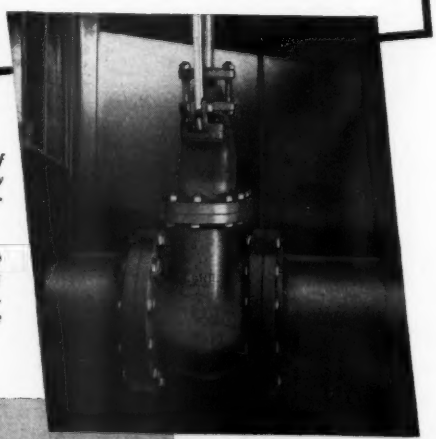
UNDIVIDED RESPONSIBILITY for piping materials—helps you to get the best installation and to avoid needless delays on piping jobs.

UNIFORM QUALITY—The name Crane on piping materials—highly respected through 90 years—certifies dependable quality in every item. It assures highest efficiency in pipe lines—at lowest cost.

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



ON SETTLING CONE, *a nest of Crane Standard Iron Body Wedge Gate Valves with non-rising stem.*



CIRCULATING WATER LINE *showing 12-in. Crane lever-operated Iron Body Gate Valve with extension stem.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
HEATING • PUMPS

CRANE

FOR EVERY PIPING SYSTEM

Here is a truly balanced bogie...

It's the Mack bogie . . . specially designed by Mack engineers . . . built only in Mack factories. Because of perfected balancing it handles big loads over bad ground in an outstanding manner.

This bogie assures equal traction, even tire loading, and uniform braking regardless of road conditions. Weight transfer is virtually eliminated, as is hopping and rearing. It embodies self-steering qualities. Wheels roll freely on turns without scuffing or wheel-fight.

Three built-in Mack exclusives are among the important advantages of this bogie: the Power Divider which transfers driving power to the wheels having the best traction . . . rubber Shock Insulators which make twisting of springs impossible . . . and the low trunnion position which aids in canceling weight transfer.

Thanks to its simple, robust construction and balanced stress distribution, maintenance is greatly reduced.

The Mack bogie is a typical example of the way Mack designs and builds trucks down to basic working parts to meet specific job demands.

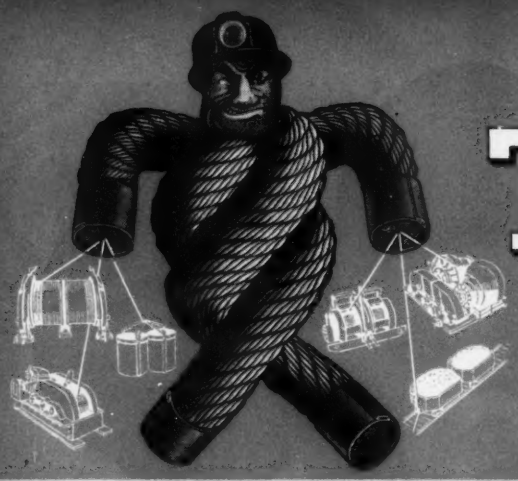
Mack since 1900, America's hardest-working truck

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada Ltd.

Trucks for every purpose

Shovels Have to Hustle

to keep up with Mack six-wheelers. Here's a nimble, big dumper..the Model LMSWM..built to a formula that swiftly transforms ore, coal, rock or earth into real pay dirt.



Tuffy WIRE

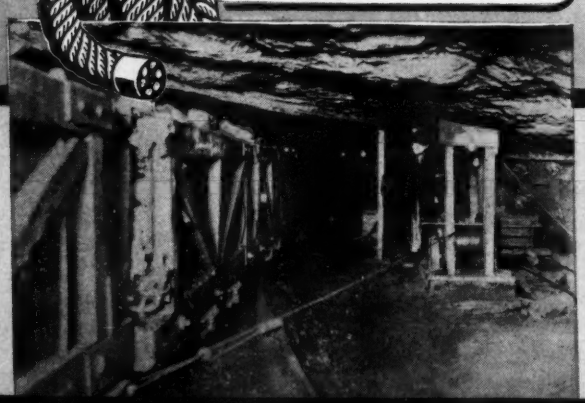
Toughest Performers in

Four rope killing conditions in slusher mining gang up to make ordinary rope short lived. Standard rope constructions are available to meet them singly but not the whole gang of them.

For many months a new wire rope (originated by Union Wire Rope Engineers in cooperation with large slusher operators) has been successfully battling this gang of rope killers. Union's Tuffy, 3-strand is cutting slusher rope costs 25%. Tuffy has high resistance to abrasion. Tuffy is rigid and non-collapsing to eliminate drum crushing. Tuffy has elasticity to take up the shocks of load snagging and flexibility to operate over under-sized tail sheaves without fatigue. Next time reeve your slusher loaders with Tuffy.

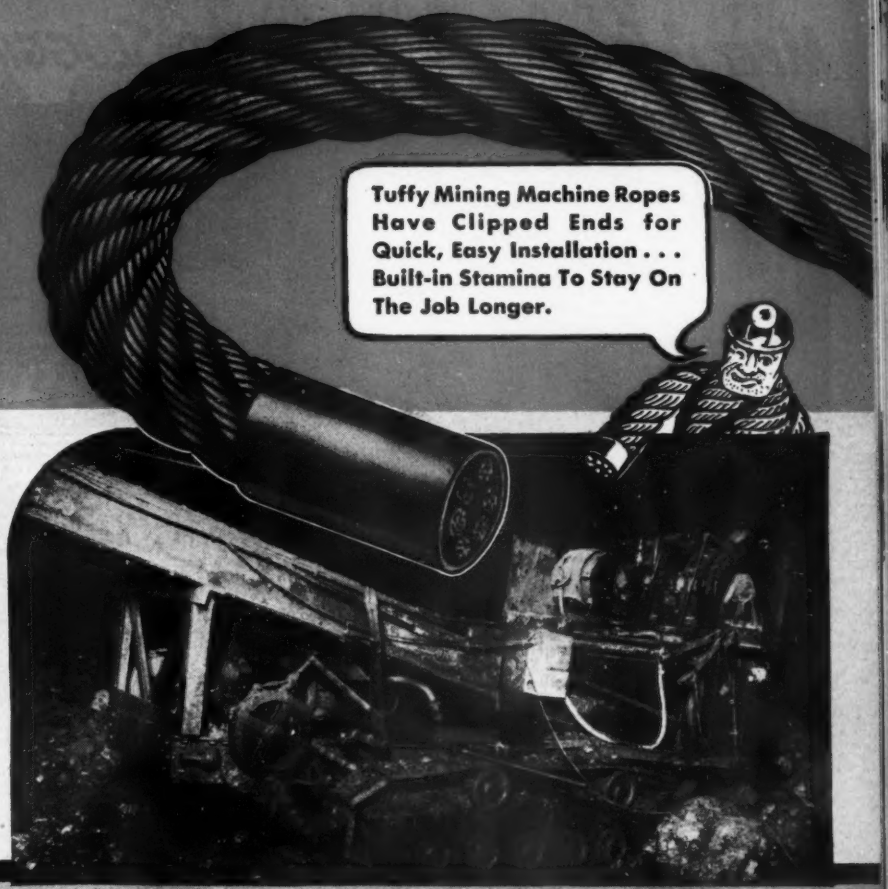
Tuffy Slusher Rope Sets New High In Slusher Mining Performance. Cuts Rope Costs 25%.

Tuffy Crab Motor Ropes Are Rugged But More Flexible For Easy Handling.

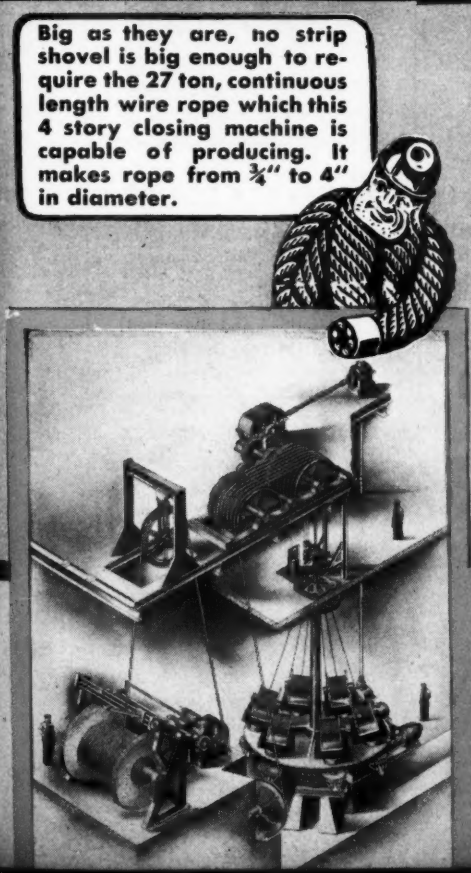


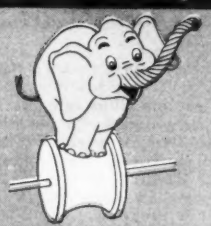
ROPES

and on Earth



There is a Tuffy wire rope fitted by specialists to every mining job. For mine work from overburden to deepest stope, Tuffy wire ropes are first designed then constructed to operate more efficiently and longer. You can't begin to match Tuffy performance with ordinary wire rope cut from stock reels. Tuffy mining machine ropes, for instance, are cut to length, end clipped, packaged and job marked. Tuffy mine machine, crab motor and winch ropes are Union-formed, i. e. pre-formed to wear and work like a trained elephant. For Union-formed 18 x 7 non-rotating hoisting ropes, yesterday's outstanding record is just an every day chore.





Union-Formed Rides Better on Grooves

. . . does not spin and grind through blocks or over sheaves.

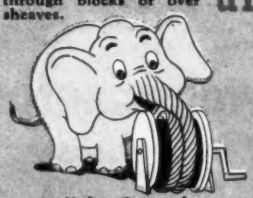
Union-Formed is Safer to Handle

. . . worn, broken wires do not spring out and porcupine but continue to lie close to the rope.

Union-Formed is Flexible and Relaxed

. . . bends in any direction, yet has "toughness" to withstand jerking and other punishing strain.

union-formed is *Preformed*



Union-Formed Spools Better

. . . even with a light load it winds evenly and tightly.

Union-Formed Resists Kinking

. . . because wires and strands are free of internal stress, they do not fight to get out of their pre-formed positions.

Union-Formed Resists Bending Fatigue

. . . withstands more bends, even reverse bends, because it is more stress-free internally.

union *Wire Rope* CORPORATION

2144 MANCHESTER AVE.
KANSAS CITY 3, MO.

Send the facts on Tuffy . . .

- ☐ Slusher Ropes
- ☐ Mine Machine Ropes
- ☐ Winch Ropes

FIRM NAME _____

BY _____

MEET A FAST-WORKING, HARD-SLUGGING NEWCOMER

You'll find the WPM Drifter, newest of the famous Blue Brutes, has the speed, punch *and balance* of a real champion — at all weights. Look at a few of the features that give it "the edge" over the field:

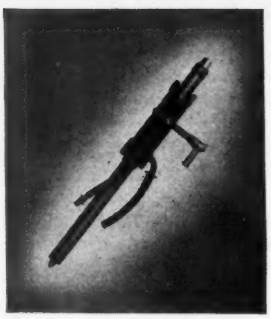
All moving parts of the Pneu-Motor feed are enclosed in oil and consolidated in the Drifter, making a single compact unit . . . Simple spur gears, instead of old-fashioned internal or planetary types . . . No ratchets, pawls or springs . . . Only one air hose . . . Pneu-Motor easily dismantled without taking Drifter apart . . . *Standardized mountings take all three sizes of WPM Drifters.*

These design advantages are making good in a big way. Reduced weight of each unit makes handling easier, while the balanced feed lessens recoil and provides smoother action. This better balance also relieves stress and wear on the guide shell, stops excessive vibration and whipping. Control is easier, because feed and drifter controls are both located on the end of the drifter.

Here's unbeatable performance that pays off in faster drilling cycles, more footage with less effort, and all-around operating economy. That goes, too, for the other new Blue Brute Drifters — the WPMS (Pneu-Motor on shell) and WHC (Hand Crank) types. Each type comes in three cylinder sizes — 3", 3½" and 4" — covering the whole range of drifter jobs, yours included, in a way that proves *there's more worth in Worthington.*

Write for literature describing the complete line of BLUE BRUTE Mining Equipment, including Drifters, Stopers and Hand Held Drills.

H7-1

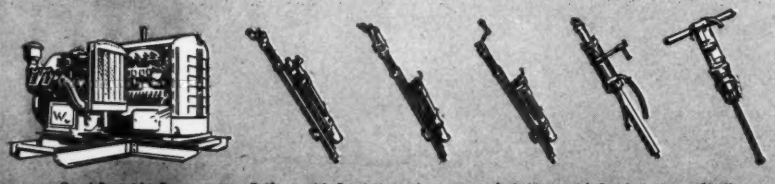


BLUE BRUTE STOPER

Self-Rotating Model WR-31 is well balanced, easily handled, and has many features that make it attractive to miners. Fully described and illustrated in Bulletin H-1200-B30.

Get more WORTH from air with WORTHINGTON

BUY BLUE BRUTES

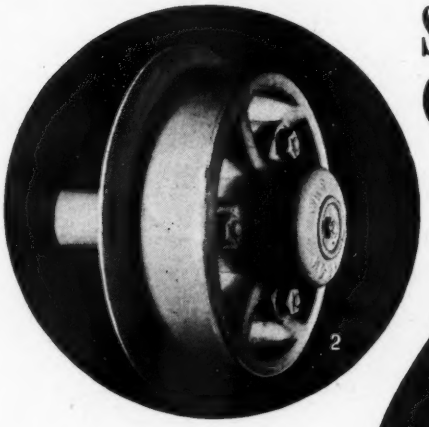


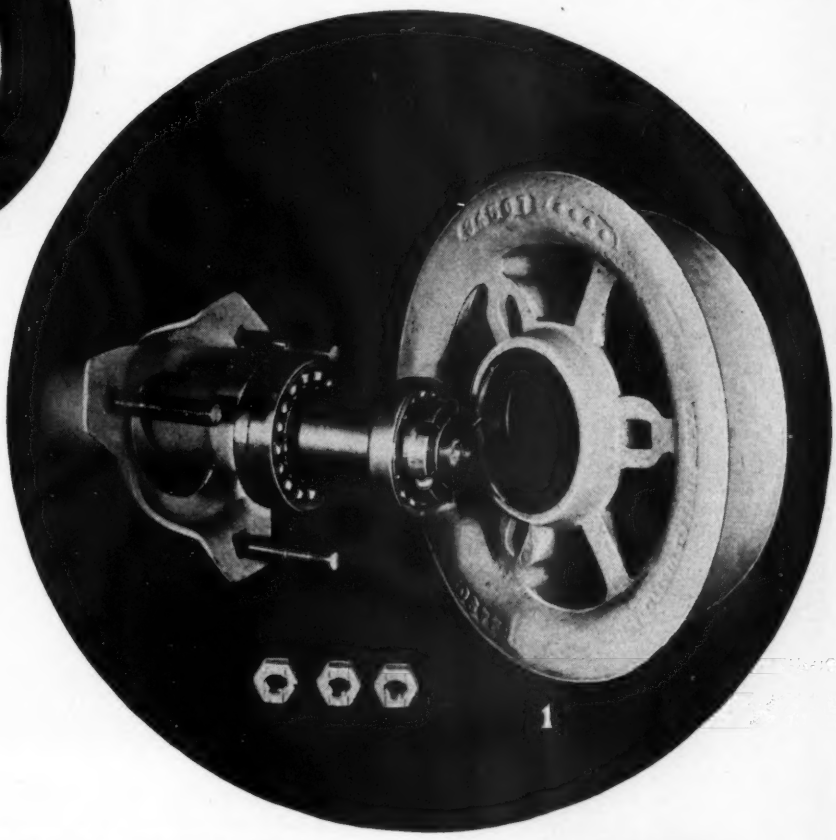
Semi-Portable Compressors. Drifters with Feed Motor Incorporated. Drifters with Feed Motor on Shell. Hand-Crank Drifters. Stopers. Hand-Held Rock Drills.

WORTHINGTON

Worthington Pump and Machinery Corporation. Worthington-Ransome Construction Equipment Division Holyoke, Mass.

SAVE YOUR MINE MONEY WITH OUR "5 YEAR PLAN" ON WHEELS!





S-D "Floater" Ball Bearing Closed Hub Wheels are backed by a written guarantee that protects you for five years against undue wear or breakage of wheel castings, and failure of bearings. And, if you have to grease "Floaters" more than once in five years, we pay the extra cost. If the S-D "Floater" wasn't the most perfect, simplest, easiest running and most economical wheel for the mining industry today we just couldn't afford to make this offer. In addition, with "Floaters" you can increase the net loads handled by your locomotives up to 50 percent. You can't afford to be without S-D "Floaters."

The illustrations on this page show how simple it is to demount the "Floater." Photo 1 shows how the bearings remain on axle in perfect adjustment when wheel is removed. Photo 2 and 3 show the front and rear of the wheel and how it is held in place with only 3 bolts. This simplicity of design makes it possible to remove and replace the "Floater" as easily and quickly as changing an automobile wheel.

Better check your present wheel maintenance costs. Then write to us for the complete story on S-D "Floaters" including information on how to take advantage of our Free Trial Offer.

Sanford-Day Iron Works, Knoxville 9, Tennessee

A leader in portable air power and a leader in rock-drilling equipment join to give you new standards of rock-drill service and performance

Service

We are emphasizing prompt, efficient service because it is a basic Le Roi policy. It is so important to us that no one holds a Le Roi franchise who doesn't conform to our rigid requirements. Nation-wide, Le Roi service is handled by well-trained, experienced, and competent men. All service outlets are conveniently located to assure you of speedy attention.

Performance

Users tell us that the AIRMASTER line of compressors is portable air power at its best. These fine compressors are now teamed with the well-known line of popular, fast-drilling Cleveland rock drills. For example, the 55-lb. H-111 hand-held drill, thanks to a happy combination of high drilling speed, dependability, and easy holding, is hard to beat. The Cleveland wagon drill establishes new drilling records almost everywhere that it is put to work — unusual flexibility and the power to drill deep holes are mainly responsible. Mines, with the job of producing metals critically needed in our economy, call on Cleveland drills to help step up their tonnages.

The Future

Le Roi and Cleveland Rock Drill are now one — this includes all Cleveland's basic patents and all patents pending. Cleveland and Le Roi designers and metallurgists are all members of the same family. To rock drill users, this combination of talent and experience means, in addition to new standards of service, future developments that will further serve to reduce drilling costs.

LE ROI COMPANY

Cleveland Division

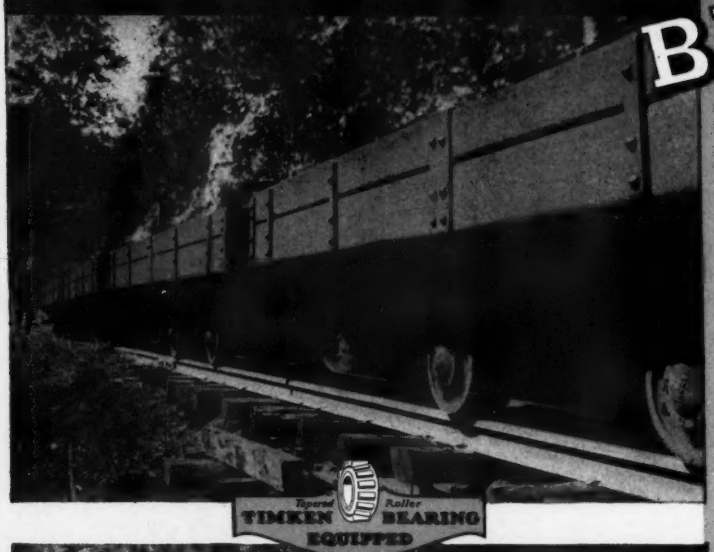
Manufacturers of Cleveland Rock Drills

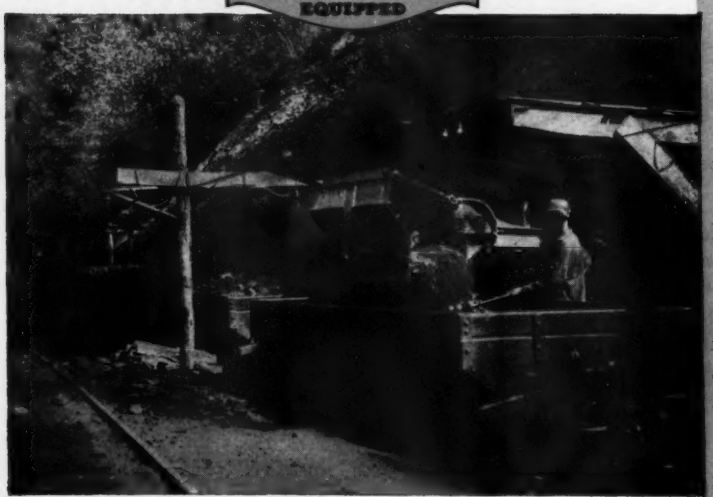
CLEVELAND 11, OHIO

LE ROI COMPANY, *General Offices*, Milwaukee 14, Wis.

New York • Washington • Cleveland • Milwaukee
Birmingham • Tulsa • Butte • San Francisco

Anchor Coal puts new 5 ton capacity cars in service on TIMKEN BEARINGS





These big drop-bottom cars represent part of the Anchor Coal Company's mechanization program at their No. 5 Powellton mine, Whitesville, W. Va.

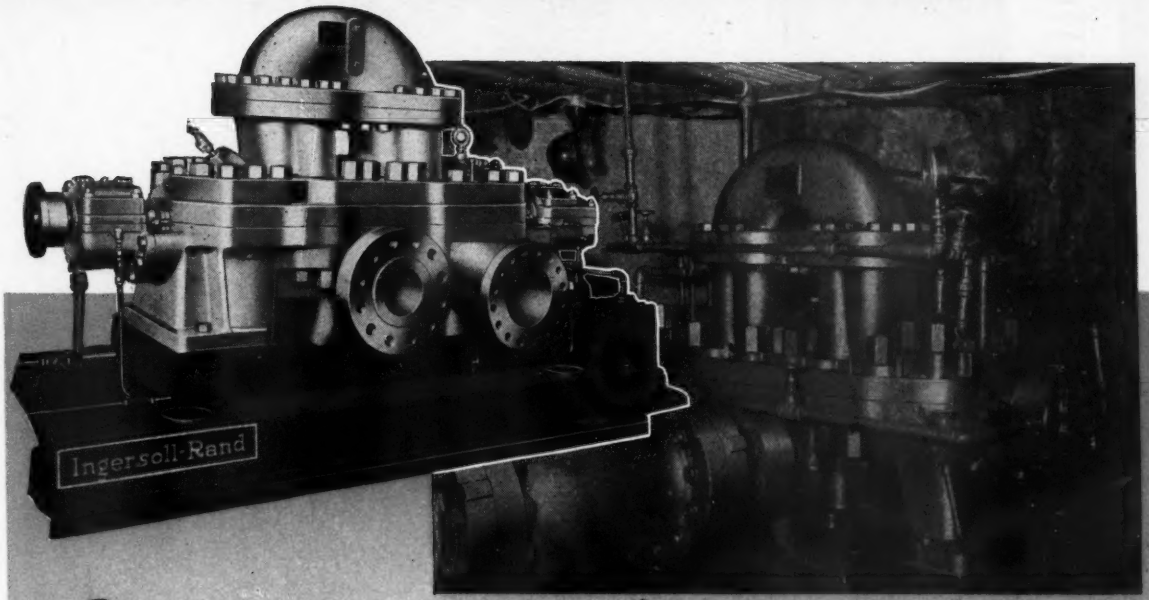
They were built by American Car and Foundry Company and are equipped with Timken Tapered Roller Bearings on all axles.

Timken Bearing Equipped mine cars form the backbone of mechanized efficiency and economy in more than a thousand mines.

No program of mechanization that does not include them can be expected to achieve maximum results, for the only coal that pays is *coal at the tipple.* The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

To Mine Equipment Manufacturers:
Look for the trade-mark "TIMKEN" on every bearing you use.



Making water flow up-hill

Yes, water has to flow up-hill to drain a mine. It is the job of Ingersoll-Rand mine pumps to push this water to the surface—it's a tough job, too. The water is often highly corrosive and erosive, and the distance to the surface may be thousands of feet. Class RT station pumps have been eminently successful in many mines. Here are a few of the reasons.

- *Materials selected by the I-R metallurgical department resist the action of corrosive and erosive waters.*
- *Careful impeller design and large, smooth liquid passages result in high efficiencies that keep power costs down.*
- *Large oil-lubricated bearings keep the unit running smoothly hour after hour and month after month.*

These and many other features make Class RT pumps ideal for mine service. An I-R engineer will be glad to tell you about them. Remind him also to give you a copy of our mine pump bulletin, Form 7071. Ingersoll-Rand Company, Cameron Pump Division, New York 4, N. Y.

COMPRESSORS
TURBO BLOWERS
OIL & GAS ENGINES
PUMPS
CONDENSERS
AIR TOOLS
ROCK DRILLS

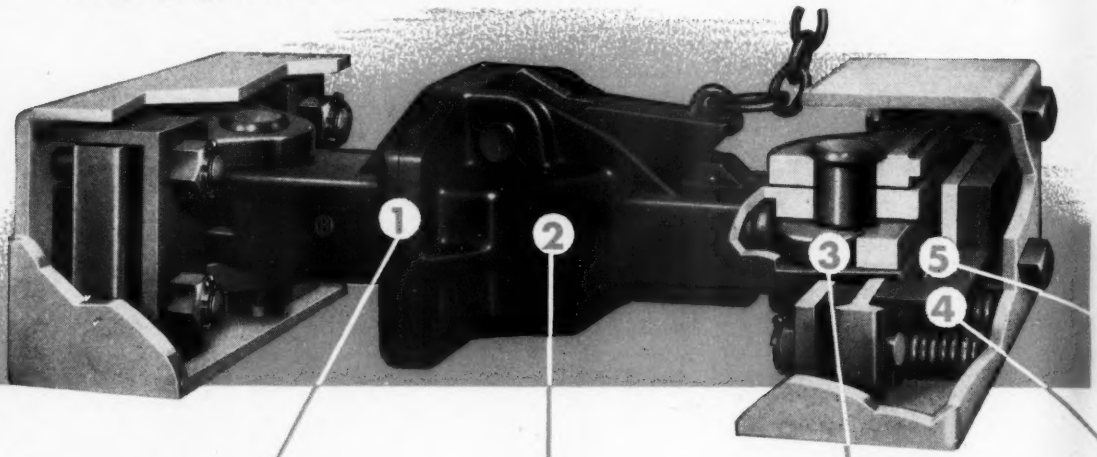
Ingersoll-Rand

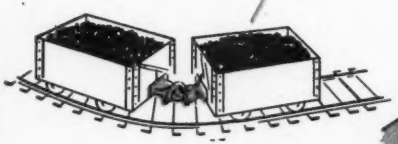
11 BROADWAY, NEW YORK 4, N. Y.

10-687

5 Reasons Why

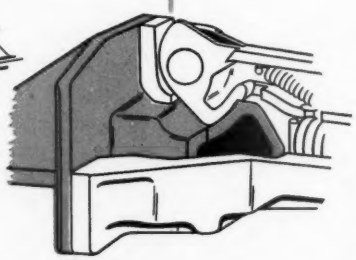
O-B AUTOMATIC COUPLERS GIVE YOU





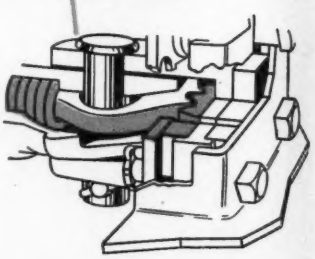
EXTRA-WIDE GATHERING RANGE

With O-B's male-and-female type coupler heads, maximum gathering range is provided. Depending upon the car construction and its relation to the track, O-B Coupler-equipped cars will operate over and automatically couple upon curves of minimum radius.



POSITIVE INTERLOCK

Once coupled, O-B Automatic Couplers stay coupled. There's no chance of accidental disengagement or inter-coupler movement. A moveable cam on the female head fits snugly into a corresponding notch on the male head. The harder you try to pull the heads apart, the tighter the cam fits into the notch.



AUTOMATIC SELF-CENTERING

There's no need to align O-B Coupler heads manually before coupling — a self-contained centering arrangement automatically keeps the heads in center-to-center alignment. An important safety feature, automatic self-centering keeps your workmen out of the danger zone between two mine cars.

MORE FOR YOUR EQUIPMENT DOLLAR

O-B Automatic Mine Car Couplers bear little resemblance to railroad couplers —and for very good reasons! Mine haulage conditions are different. Shorter curves and more frequent operation on curves make extra-wide gathering range a necessity. Cars must be made to operate over sharp breaks in grades at dips and knuckles. Impact blows from surging are proportionately more severe requiring a draft gear of ample capacity. A stabilizing pressure is needed to counteract a mine car's normal tendency to derail under push or buff.

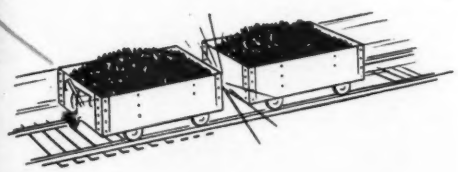
To meet these and other conditions peculiar to mine haulage, O-B discarded railroad-type designs and developed the coupler shown here — a coupler whose mine-engineered extras assure its proper functioning under mine service. Don't fail to investigate it if you are contemplating the purchase of new mine cars. A postcard request will bring full information.

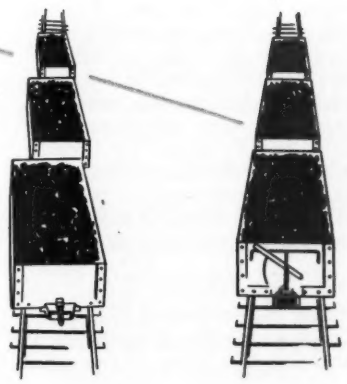
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

2756-AM





EXTRA-CAPACITY DRAFT GEAR

Tough, springy rubber buffing pads replace breakable steel springs in O-B's modern draft gear assembly. Completely enclosed, the rubber draft gear will absorb impact blows up to 50,000 pounds — as much as 100,000 pounds on the new Form-8 design.

INCREASED TRACK STABILITY

New in principle, the improved Form-8 Coupler actually helps to keep your mine cars on the track by preventing buckling under push or buff. Cars are held in center-to-center alignment on the track, are not allowed to zigzag as is the car's normal tendency under push or buff.

Introducing–the New, Revolutionary KENNAMETAL PERCUSSION BIT for Pneumatic Jack Hammer Rock Drilling

It's the FIRST bit ever designed with a cemented carbide cutting edge that fulfills all practical requirements of pneumatic percussion rock drilling at the high air pressures (80 to 120 pounds per square inch) used in the United States.

KENNAMETAL—the cemented hard carbide that revolutionized steel-cutting, steel-milling, and cutting and drilling in coal and non-metallic mines—is now ready to produce equally outstanding results on pneumatic percussion drilling of hard rock formations. The chisel-type bits shown at the right have Kennametal cutting edges, and are so designed that best use is made of Kennametal's tremendous compressive strength and high resistance to abrasive wear.

These bits have been widely tested on granite, silica sand rock, hard limestone, and other hard rock substances. Service reports (of which the two at the right are typical) are remarkable—the Kennametal cutting edge successfully withstands the hammering of high air pressures . . . drills through hard rock formations with unprecedented speed . . . holds an effective cutting edge for greatly extended periods of drilling . . . and can be resharpened time and again! Furthermore, less compressed air is used, the periods of operation between bit changes are much longer, and the cost of bits per foot of hole drilled is greatly reduced.

Kennametal Percussion Bits are suitable for dry or wet drilling. When drilling dry holes the amount of heat generated has been found to be negligible. When wet drilling is done, water is supplied through the holes in the side bevels of the bit.

These bits are now being manufactured in two sizes; $1\frac{3}{8}$" costing from $8.10 to $9.70 each; and $1\frac{5}{8}$" costing $9.50 to $11.40 each depending upon quantity purchased.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

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KENNAMETAL *Inc.*, LATROBE, PA.

Performance That Is Unequalled In The History of Percussion Drilling!

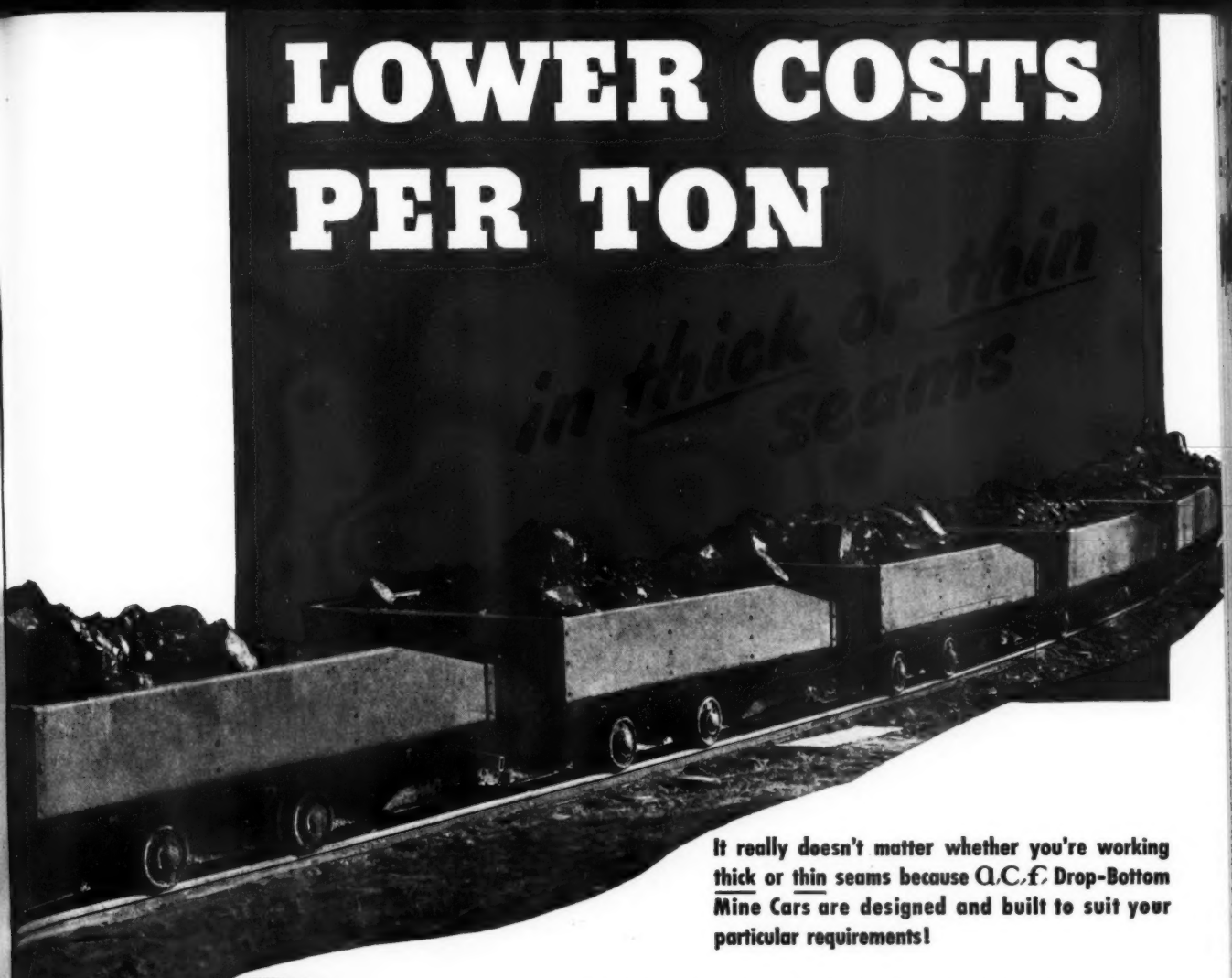
198 Feet of Holes Drilled in Hard Silica Sand Rock in 308 Minutes!

An unused Kennametal Percussion Bit (left) and at the right, one after it had drilled 198 feet, in 308 minutes *without being resharpened,* in hard silica sand rock which forms the roof of a Cambria County, Pa. coal mine. It took 188 steel bits 1210 minutes to drill the same footage. Kennametal Bits saved almost 15 hours! The 188 steel bits cost almost 5 times as much as the one Kennametal Bit, and were completely worn out. The Kennametal Bit can be resharpened, and is good for many more feet of drilling.

50 Feet of Holes Drilled in Barre Granite in 50 Minutes!

The used Kennametal Percussion Bit at the right above drilled 50 feet of holes, $1\frac{3}{8}$" in diameter, at the rate of one foot per minute, in solid Barre granite before being taken off the driving rod to be sharpened. Compare it with the unused Kennametal Bit shown at the left. In this same substance, a steel bit wore out after drilling only $1\frac{1}{2}$" inches.

LOWER COSTS PER TON



It really doesn't matter whether you're working thick or thin seams because a.c.f. Drop-Bottom Mine Cars are designed and built to suit your particular requirements!

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DROP-BOTTOM
MINE CARS

REGARDLESS of car height, you get a strong, sturdy, well-built car, with plenty of stamina—with heavy-duty, double action spring bumpers—with doors that are "lubricated"—with anti-friction bearings in the wheels!

The unusual speed at which a.c.f. drop-bottom cars can be dumped makes them especially suited to mechanical mining. Rapid, automatic unloading at the dump hopper allows quick return of cars to the loading point—provides greater loading machine efficiency—permits lower production costs per ton!

Our sales representatives are anxious to discuss the advantages of this type car with you—for use in *thick* or *thin* seams!

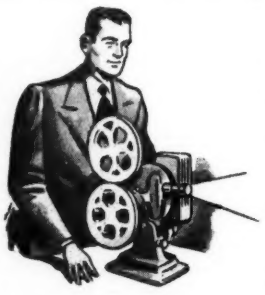
AMERICAN CAR AND FOUNDRY COMPANY

Telling the Public the Facts About Our Industry

B. C. I. Speakers' Bureau and Motion Picture Program Spread Correct Information

● Organized to bring authoritative representatives of our industry face to face with influential audiences throughout the country, the Speakers' Bureau is one of the Bituminous Coal Institute's most rapidly expanding activities. *In its first half-year the Bureau filled 257 requests for speakers*—and the demand is constantly growing. Currently, invitations to send speakers are being received at a rate of more than three a day.

Already, more than 150 volunteer speakers are available to tell the facts about coal to business and civic clubs, lodges, schools, and similar groups. Most of these speakers are coal company executives. They give their time and talent to fill speaking dates in their own or neighboring communities. The Institute supplies them with a selection of speech material that can be used as it is written or as a help in organizing individual talks.



Special Movie Audiences

In addition to the growing audiences reached by these coal industry speakers, hundreds of other groups are hearing and *seeing* facts about the industry through circulation of "The Magic of Coal." In eighteen interest-packed minutes, this sound motion picture gives a dramatic view of many aspects of coal, from modern mining methods to the varied end uses of coal and its by-products. Circulated by two national film libraries, this Institute-sponsored picture has been in brisk demand and is being seen by increasing thousands.

Both the Speakers' Bureau and the Institute's motion picture activity are organized to serve the industry. You are urged to take advantage of them in your community or for those you serve. Ask the Bituminous Coal Institute for details as to how you can use them to your own and our industry's advantage.

These activities are part of the Institute's broad public relations program. It is a program with three years of solid accomplishment behind it. Now, with an even more helpful future, Bituminous Coal Institute deserves the active support of every forward-looking Bituminous Coal operator.

BITUMINOUS COAL INSTITUTE

Washington, D. C., Affiliate of National Coal Association

BITUMINOUS COAL . . . LIGHTS THE WAY . . . FUELS THE FIRES . . . POWERS THE PROGRESS OF AMERICA

Bethlehem's No. 5 steel tie will bear the full weight of your heavy motors, cutters, and loaders. Built to take abuse, it embodies a quarter-century's experience in the manufacture of steel mine ties—millions of them.

HEAVIER STEEL TIES

MEAN MORE VALUE PER DOLLAR

Today the demand for heavier steel mine ties is greatly on the increase, spurred by the use of modern, highly-mechanized equipment.

This bears out what we have said for a long time: under present conditions the heavier ties give *greater value per dollar*—better and longer service—than lightweight ties.

A Bethlehem No. 5, for instance, weighs 5 lb per ft of section. It is built specifically for the popular 40-lb rail so widely used with heavy track-mounted equipment. Yes, its initial cost is higher than that of a No. 2 or a No. 3. But it will last so much longer that its purchase is economy in the end.

It is not at all uncommon for a Bethlehem No. 5 to be taken up and reused 25 times or more. Ask for full details.

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BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

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More Crowd Faster Return

. . . it's an Airslusher, of course!

IT'S the big, powerful 5-cylinder radial air motor—with its extremely high torque—that gives this Gardner-Denver Airslusher more crowding action and a faster return of the empty scraper. The motor doesn't depend on high r.p.m. for its power. It does its job efficiently even at lower speeds—and the motor uses air only when it's doing useful work—no wasteful running between trips.

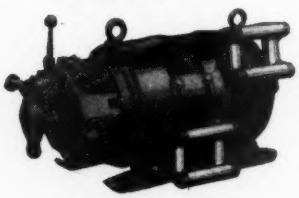
Ability to lug bigger loads—faster—is a reason why Airslushers are replacing so many older type machines today. Here are some of the other features which make Gardner-Denver Airslushers unique of their kind:

Single throttle lever—*operation so easy that the operator can move lever with two fingers. The lever operates Airslusher in either direction and automatically returns to neutral when released.*

Compact design—*plus light weight for exceptional convenience in moving through small raises and chutes into stopes.*

Simple design—*fewer gears, bearings, oil seals and lubrication points.*

Simple roller clutch—*applies power at will to either drum by reversing air throttle. No clutch levers to handle—no adjustment or lubrication of the clutch is ever necessary.*



Gardner-Denver Airslushers are supplied in three sizes — 850, 2000 and 2500 pounds rated capacity rope pull.

GARDNER-DENVER
SINCE 1859

For complete information, write
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It was a tough load of clay and rock to move but the Internationals were a match for it and the job paid off in profits.

International Diesel Crawlers turn in performance records on jobs like this that mean big accomplishments at minimum operating cost. For example, fuel consumption is at a record low.

Features of the International Diesel engine that powers these earth-moving tractors give you the advantage of better conversion of fuel into power, the benefit of precision-type bearings, Tocco-hardened crankshafts, and International's dependable 4-cycle, valve-in-head design.

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Choose International Diesel Crawlers for your earth-moving power—for building and maintaining access roads—for moving supplies and equipment. Ask the International Industrial Power Distributor near you to assist in selecting the crawlers, power units and Diesel engines that will suit your needs best.

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CRAWLER TRACTORS • WHEEL TRACTORS • DIESEL ENGINES • POWER UNITS

Mining
CONGRESS JOURNAL

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JULIAN W. FEISS, Editor

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FRIGID DESPERATION

WE DO not know how deeply the "Have Not Theory" has become ingrained in our national thinking. Were certain newspaper stories to be accepted at face value, it would appear that the United States has become sufficiently desperate in its search for minerals to send Admiral Byrd south to the Antarctic on a glorified prospecting trip.

Although it has been publicly stated that this is not the purpose of the expedition, the idea seems to persist that search for uranium and other rare minerals is the primary object of this venture. Apparently Antarctica is a treasure house of mineral wealth, a vast unexplored continent from which future generations are to derive benefits of mineral production long after known resources are exhausted in temperate zones.

The truth is that the Antarctic zone is the most forbidding and isolated area of the earth. In the north polar regions above 60 degree latitude there are over a million permanent human inhabitants and flourishing industries in trapping, timber, fishing and mining. In the corresponding regions in south latitude there are no land animals larger than an insect, no vegetation other than moss and lichen, no human inhabitants and no industry except whaling, an enterprise of precarious nature existing about three months each season.

The mean temperature anywhere in Antartica during the warmest month of the year is rarely above freezing. For six months the ice-bound continent is enveloped in darkness—the silence of frozen plateaus broken only by howling blizzards. Capt. Robert F. Scott's expedition in 1911 recorded temperatures of 109½ degrees of frost (—77½ degrees F.) near Cape Crozier at the sea, not in the interior of the land mass where temperatures may become even lower.

The continent is an elevated plateau area of about five million square miles (United States roughly 3,026,000) with less than 100 square miles free from permanent ice. Estimates state that this ice sheet probably does not exceed 2,000 feet in thickness except in basin depressions. However, in a few mountainous regions where small portions of terrain are free of ice and snow, geologists have been able to investigate the rock exposures and their reports are instructive but not very exciting to those searching for mineral deposits.

To date the most important find of possible economic value is coal, located between King George V Land and the Ross Sea. The existence of uranium, or other minerals for that matter, under the ice blanket is entirely speculative. Even were scientists successful with Geiger-Muller Counters in spotting radioactive minerals beneath a thousand feet of ice, nobody has yet suggested how to mine the deposits.

Although a few metallic mineral specimens have been found in Antarctic glacial debris and at exposed rock outcrops in the pre-Cambrian schists and gneisses, similar occurrences are world-wide and many in the temperate zones are still awaiting investigation.

So far, to the best of our knowledge, prospectors have expressed little interest in the region. We doubt if the climate has dissuaded them. Climate has never prevented a gold rush and a diet of whale blubber and moss would only whet their appetite. We suspect that the prospector has his eye on more promising territory closer to home markets.

Admiral Byrd's expedition will undoubtedly contribute to our scientific, geographical and military knowledge. The value of this work is not questioned. If, however, the public expects great mineral finds to result from these efforts we anticipate disappointing results. Despite the presence of coal, and there is an abundance of this substance closer to home, the only other mineral that has been found in large quantity is ice—and there is too much of it.

AN EXPENSIVE LUXURY

ASIDE from the cost of last year's coal strikes to domestic industry and the public, the loss to the miner on a dollar and cents basis reached serious proportions. Probably very few coal miners realize to what extent they were guinea pigs in an expensive experiment in power politics.

According to the Solid Fuels Administration—a Government agency in a position to know—the average coal miner lost $600.88 during 1946. He was on strike twice, in the spring and in the late fall. The total number of working days lost was 54. The total cost to 400,000 miners was $240,352,000, at a rate of somewhat over $4,450,000 a day.

The more thoughtful coal miners have probably begun to reckon the expense of this folly. If they assume that the $600.88 is their only loss, which is far from the case considering the recent inroads of oil and natural gas, they probably realize that this sum very nearly represents the cost of a pre-war automobile. It can easily represent a year's rent for a small family. In terms of insurance, it could represent over 4½ years of premiums on a $5,000 life policy were the insurance taken out by a miner at the age of 25. For a family of four people this sum is about 5 months of food. Six hundred dollars is more than ample for a two weeks vacation for wife and children. Six hundred dollars will buy a complete new set of household appliances including a radio and washing machine, it will buy new furniture, a new wardrobe for the family and furnish a large part of the down payment on a home.

To sum up the situation, would any coal miner consider that strike gains obtained during 1946 justified an out of pocket expense of $600.88? The autumn strike was a dead loss. What gains may have been made in the spring were more than offset by rising living costs to which his strike contributed materially.

The spring strike cost the nation 70,000,000 tons of unmined coal, the fall strike 25,000,000 tons—total 95,000,000 tons that did not go into manufacturing, processing, heating and transportation. Some portion of this deficit could also be added to the $600.88 lost by the miner. In striking a balance on a profit and loss basis to the coal miners, it appears that over-indulgence in power politics by a labor leader can be an expensive luxury.

"Portal-to-Portal" Legislation

Statement of Julian D. Conover, Secretary, American Mining Congress, Before a Subcommittee of the Senate Committee on the Judiciary, January 22, 1947

THE legislation now before your committee is of particular concern to the mining industry. Pending and prospective claims for back pay for non-productive activities, based on the Mt. Clemens decision,* would not only wreck large segments of our industry but in doing so would have grave consequences to the future economy and even the military security of our country. We believe it the duty of Congress, in the national interest, to take prompt and decisive action to end this threat.

The suits now being brought against mining employers are largely independent of the previous portal-to-portal controversies, involving travel-time underground, which were passed upon by the Supreme Court in the Tennessee Coal, Iron and Railroad and the Jewell Ridge cases.† The present suits deal with alleged travel-time and make-ready activities on the surface at mining plants and at the mills or concentrators, smelters, refineries and related plants.

Potash Companies First Victims

In the case of three large potash mining companies in New Mexico, which were among the first victims of the present "portal-to-portal" epidemic, overtime pay and "liquidated damages" have been sought not only for alleged time spent walking to the shaft collar, to shops, in changing clothes, etc., but for the 20-mile bus ride between Carlsbad, N. Mex., and the various mines. Successful prosecution of these suits could bring judgments of $8,000 to $10,000 per employe, to cover non-productive activities which the union had never so much as suggested should be paid for. Similar suits have been and are being brought against other mining companies.

The unfairness and injustice of these claims is evident. Mining employers have consistently tried to comply with the Fair Labor Standards Act in accord with accepted practice and the interpretations of the Administrator and the courts. Representatives of the Wage-Hour Administrator have reviewed the operations and records of hundreds of mining employers, and have either affirmatively approved the payroll practices or by their silence have indicated that the requirements of the Fair Labor Standards Act were being met.

History of Travel-time Pay

As to underground mines, the Administrator took the position that working time for purposes of the act should in general be determined by prevailing customs and the history of collective bargaining. Accordingly in 1940, at the request of both coal mine operators and the mine workers' union, he validated the so-called "face-to-face" basis for computing work time in coal mines, to include only time spent at the actual working place. The United Mine Workers of America joined with the operators in a letter to the Administrator, stating:

"The uniform high rates of pay that have always been included in the wage agreement of the mining industry contemplate the employe's working day beginning when he arrives at his usual working place. Hence, travel time was never considered as a part of the agreement or obligation of the employer to pay for in this industry, nor as hours worked by the employes, and this has been the case since the eight-hour day was established in the industry—in 1898."

Subsequently the mine workers, in order to circumvent the Wage Stabilization law and regulations limiting direct wage increases, reversed their position and demanded "portal-to-portal" pay. Mr. Wayne Morse, then a member of the National War Labor Board and now U. S. Senator from Oregon, objected to this demand, pointing out that it was simply a subterfuge on the part of Mr. John Lewis to obtain a forbidden wage increase. The Government found it necessary to take over the mines, and in the Ickes-Lewis agreement of November 3, 1943, a portal-to-portal basis was instituted which included an allowance for the time spent in traveling from the surface to the working place and return.

In the underground metal mines, practice and collective bargaining con-

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* Anderson et al. v. Mt. Clemens Pottery Company, 8 WH Cases 83, June 10, 1946.

† Tennessee Coal, Iron and Railroad Company v. Muscoda Local No. 123 et al. 321 U. S. 598, March 27, 1944; Jewell Ridge Coal Corporation v. Local No. 6167, UMWA (325 U. S. 161, May 7, 1945).

tract provisions had varied in different areas. On March 23, 1941, the Wage-Hour Administrator issued a modified portal-to-portal opinion, which disregarded the established practices in many areas. He held that the work-day starts when the miner reports for duty as required at or near the collar of the mine and ends when he reaches the collar at the end of the shift. He also included the few minutes spent on the surface in obtaining and returning lamps, carbide and tools, and in checking in and out. He specifically rejected, however, time such as that spent in the bath-house, changing clothes and in walking to and from the bath-house, for which the equivalent of triple pay is now being sought.

During the war, certain further controversies arose in connection with rulings by the War Labor Board to the effect that travel time at a number of open pit mines was also compensable.

Triple Pay Sought For Activities Never Considered As Work

The rulings of this Board were, of course, made under the compulsion of war necessity. To the extent that these depart from accepted practice, they place on the mining industry a burden for which there is surely no justification now that hostilities have ceased. The suits now being brought against mining employers go, however, far beyond even these administrative interpretations. They are wholly unexpected and there is no way in which they could have been reasonably anticipated. They go back for many years and cover services which both the employer and the employe thought had been paid for in full. No complaints had been made nor additional compensation asked until the suits were actually in the course of preparation.

Under these circumstances employers have not, and generally could not have, set up adequate reserves to meet these extraordinary and fantastic demands. To meet them would badly impair the capital position of even the strongest mining companies and throw many others into bankruptcy.

During the war period, prices for metals and mineral products were fixed by the OPA. The price ceilings were set at relatively low levels, and with operating costs and taxes at an all-time high, the margin of profit was generally very low and in some cases disappeared entirely. Lower-cost producers were able to make some money, but were called upon to make huge sacrifices in the form of heavy depletion of their reserves, to an extent which could not be considered economic and could only be justified as a contribution to the war effort. Higher-cost producers found themselves in difficulty, and in the case of certain metals were able to operate only by virtue of premium or subsidy payments made by the Government—the rates of payment being adjusted for each producer so as to allow a predetermined but small margin of profit. In fixing these subsidy payments the Government, as well as the employers and the workers, assumed that the wages being paid measured the full extent of the employer's liability. This same assumption was shared by employers and employes alike when they negotiated the very considerable increases in rates of pay that have been granted since 1938; and it was also shared by the various Governmental boards that passed upon these wage increases. The unfairness of now claiming triple pay at these increased rates for periods beyond the agreed work-day is apparent. It may not, however, be apparent how seriously the claims now being pressed will disrupt important segments of the mining industry and upset the general economy of our country.

Grave Consequences to Mining Industry

The mining industry differs radically from manufacturing industries. A mining operation is constantly depleting its principal capital asset—the mineral in the ground. Every day that a mine operates it is consuming a portion of its developed ore reserves, and approaching the time when these will be exhausted, except as it succeeds, through continued exploration work, in discovering and developing new reserves. During the war two things occurred: First, reserves were consumed at a greatly accelerated rate, and second, because of the need of concentrating on actual production, programs of finding and developing new reserves were reduced almost to the zero point. This is the "nub" of present-day discussions in which the United States is pictured as a "have-not" nation.

If we are *not* to be a "have-not" nation—if mine production is to be continued in the future as in the past—it is absolutely essential that large capital sums be available for exploration and development programs, and that the incentive exist to justify risking these sums for such purposes. Many of the attempts to find additional reserves or new deposits are in the very nature of things unsuccessful. The miner may be lucky if one out of ten exploration ventures discovers a worth-while orebody. Generally it takes several years, with continued heavy expenditures of capital funds, from the inception of a new mining enterprise until it comes into commercial production. Long-range planning and confidence in the future are essential. The natural risks of the business, involving all the vagaries of mineral occurrence below the ground, are hazardous enough without adding man-made uncertainties.

Against this background, the portal-to-portal suits present an extraordinary threat, inimical to the national welfare. If successfully carried through they will, at the very least, compel mine operators to take capital assets which would normally be used in exploration and development work, and dissipate them in settlement of these huge windfall payments. In many cases, they will bring bankruptcy and abandonment of operations. Even though these staggering claims are not supported by the courts, the mere pendency of the suits discourages the use of existing capital funds in necessary development work and impairs the borrowing capacity of mining enterprises. We cannot have in this country a healthy and expanding mining industry until the Congress has removed the hazard of administrative or judicial rulings which would permit heavy and unjustified liabilities to be retroactively imposed.

Economic Disaster Threatened

The effect of an unhealthy mining industry upon the rest of our economy is easy to foresee. Adequate supplies of lead, copper and zinc, for example, are essential to the electrical manufacturing industry, the public utilities, the motor industry, the construction industry and to many fabricators of metal products. At the present time the supplies of these metals are not adequate and so long as the portal-to-portal threat is continued, steps to correct the shortage will be seriously hampered. Instead of increased production to meet the expanding needs of industry and to lay the foundation for a period of high production and prosperity, existing shortages will be intensified and unemployment will be created not only in mining itself but in other industries throughout the country.

Without laboring the point, it should be emphasized that most manufacturing industries are dependent upon the products of the mines. Reduced production of metals and minerals, and of the fabricated articles into which they enter, could readily start a downward spiral of our whole economy. When we consider also the direct effects of the portal-to-portal suits upon manufacturing industries —as described by other witnesses—

(*Continued on page* 115)

ANNUAL REVIEW *and* FORECAST

Metal Mining Practice During 1946

By CLIFTON W. LIVINGSTON

Associate Professor of Mining
Colorado School of Mines

THE trend of progress in mining practice bears a direct relation to world mineral economics and takes fully into account that mining is a depleting-reserve industry and that the rate of discovery is falling. The mining industry recognizes the importance to the nation and to our future security of maintaining a strong domestic mineral position. The mining industry also recognizes fully that continued research and progress in mining practice are essential if we are to maintain a strong mineral industry.

Only a few years ago advances in technology made possible the profitable exploitation of the porphyry copper deposits, thereby converting billions of tons of waste material into ore. It does not seem unreasonable to believe that future advances in technology may make possible the profitable exploitation of tremendous deposits of taconite, and of oil shale, and of deposits of other minerals as yet unminable commercially.

Progress in mining practice continues with faith that we may triumph not only over technical problems but also over the more difficult problems of human engineering. Such progress continues so that our efforts in technology will not be wasted, so that there will be incentive for new discoveries, and so that not only the rate of new discoveries will be improved, but ore reserves will be increased as costs are lowered, thereby converting marginal material into ore.

The trend to reduce costs by increasing the output per man shift or by large-scale operation continues. Mechanization has been advanced as a result of labor shortages and current high wage rates. Improvements in methods and practices lead to development of improved equipment; in turn, the development of improved equipment leads to further advance in mining practice. The cycle of progress continues as one phase of mining practice surges forth, only to be overtaken later by progress in other phases.

Experiments Indicate Improved Drilling Methods

The trend in drilling with rock drills has been toward drilling smaller-size holes using small gauge changes and using as long a steel change as possible. The rock drill has proved most economical in drilling blast holes up to 16 ft. in depth. The diamond drill has proved most economical for drilling deeper blast holes and for drilling shorter holes in very hard rock. Progress in blast-hole drilling has been most rapid during the past two years. Experiments conducted during 1946 with tungsten carbide inserts brazed into slots in detachable rock-drill bits offer much promise to reduce further the cost of blast-hole drilling and to broaden the field of application of the rock drill.

Experimental Tungsten-Carbide Bits Show Excellent Footage

The accompanying illustrations and the following descriptions of experiments conducted by the United States Vanadium Corporation are by courtesy of Blair Burwell.* According to Burwell, "The life of a well designed tungsten-carbide bit in average rock under proper operating conditions and using a properly selected air drill will approach 80 ft. in very hard rock, 250 ft. in average rock and 350 ft. in soft rock. Starting with a gauge of 1½ in., it will finish its life with a gauge of 1¼ in. The life of the bit usually exceeds the life of the threads or coupling used to join the bit to the rod and nearly approaches the life of normal carbon drill steel. . . . The economies of air consump-

* For further information watch for "A Forecast of New Rock Drilling Methods," by Blair Burwell, to be published early in 1947 by A. I. M. E.

tion and drilling speed and the labor attendance on steel and machines forecast a reduction in the cost of drilling. The cost of bits per foot of hole will equal, or be slightly less than, the cost of conventional steel."

Superior results were achieved with tungsten-carbide bits and moderate air pressures. Bit failure was experienced in medium-hard granite at an air pressure of 100 lbs. per square inch. Continued improvement in drilling practice may call for rock drills of small piston diameter, shorter stroke, and a larger number of blows per minute.

The increased use of the burn-cut round is due to its following characteristics:

(1) All holes may be drilled normal to the face and substantially parallel to each other.

(2) Fly rock can be reduced to a minimum, and the muck pile properly placed for rapid mechanical loading.

(3) A deeper round may be broken in a heading of a given cross section than is possible using any other type round.

Experiments conducted over a period of two years by Calumet and Hecla Consolidated Copper Company, at Calumet, Mich., have evolved the "Clover-Leaf Burns."[1] The round was designed for "plastic-acting" ground but has proved equally effective in "brittle-acting" ground.

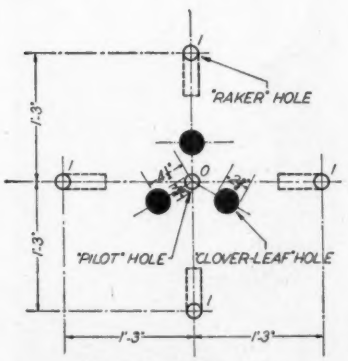
The pilot hole is loaded to the collar with low-to-medium-velocity explosive. The "clover-leaf" holes are not loaded. Superior results are achieved if the volume of the membrane between the pilot hole and each of the clover-leaf holes does not exceed one and a half times the volume of the clover-leaf hole.

"The trend in mine development has been toward concentrating and localizing the stoping area to control subsidence, reduce maintenance on extraction openings, improve ventilation and provide closer supervision."

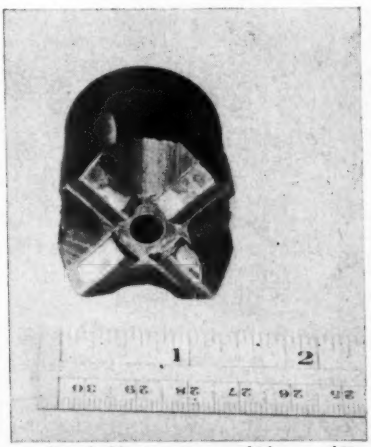
The drills of new design may permit the use of smaller-diameter drill steel and a further reduction in the size of bits and of the finished hole. The use of smaller steels may call for increased use of alloy drill steels in place of standard high-carbon drill steels. The drilling of smaller holes with little loss of gauge from collar to bottom may call for smaller-diameter explosive cartridges of high-density explosive and may eliminate the use of spaced charges.

The Burn-Cut Round Has Definite Advantages

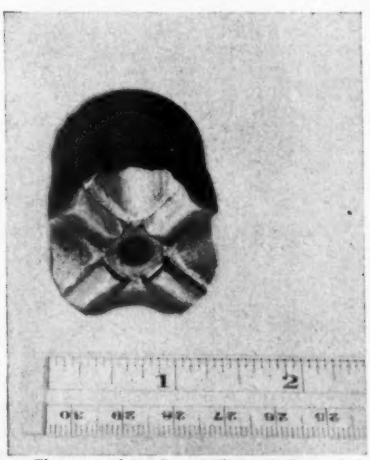
The drill round used in development headings has been modified to take advantage of progress in drilling practice and to speed up the mucking cycle. The burn-cut round has been used to a larger extent in mine development for it fits well into present practice and will probably meet the requirements of future practice as drilling with tungsten carbide bits comes into general use.



"Clover-Leaf" Burn Cut



A detachable tungsten carbide crossbit



The same bit after drilling 60 feet of of hard silicified limestone

Fusion-Piercing

The trend of blast-hole drilling in open-pit mining has been toward the use of large-diameter holes and increased spacing between holes to reduce the cost of breaking. The rate of penetration with a churn drill is not a function of the area of the hole, as in drilling with rock drills, but is about the same for a nine-inch-diameter hole as for a six-inch-diameter hole. In moderately hard rock, penetration averages about 5 ft. per hour. In very hard rock penetration may be 1 ft. per hour or less. "Fusion-piercing," while still in the experimental stage, offers promise of reducing the cost and increasing the rate of drilling, particularly in very hard taconite iron deposits.

The photographs and the following description of the patented process of fusion-piercing are by courtesy of the Linde Air Products Co.[2]

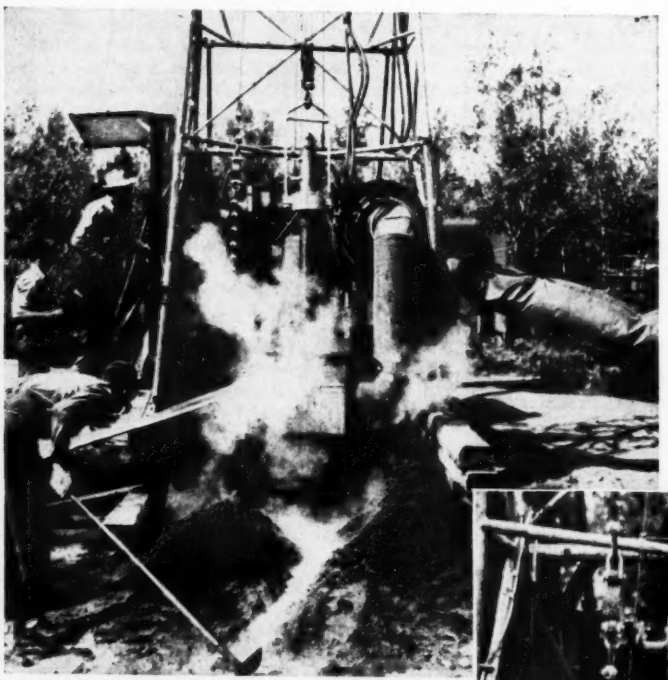
"In fusion-piercing a flame, produced by burning oxygen and a flux-bearing fuel in a special blowpipe, is directed against the surface of the rock or ore. The high flame temperature—about 4,000 degrees F.—causes some kinds of rock to spall or flake off. Flux in the fuel causes other kinds of rock to melt. Pressure of the burning gases forces the molten material past a water spray where it is quenched and broken up. In the quenching process, water turns to steam and the steam helps the gases force the quenched material out of the hole. . . . Field tests were made on Minnesota 'taconite,' an extremely hard, tough, abrasive, low-grade iron ore. Six-in. holes up to 30 ft. deep were fusion-pierced at an average rate of 10 ft. per hour, with rates as high as 17 ft. per hour for short periods. This compares with an average speed of 1 ft. per hour for drill-

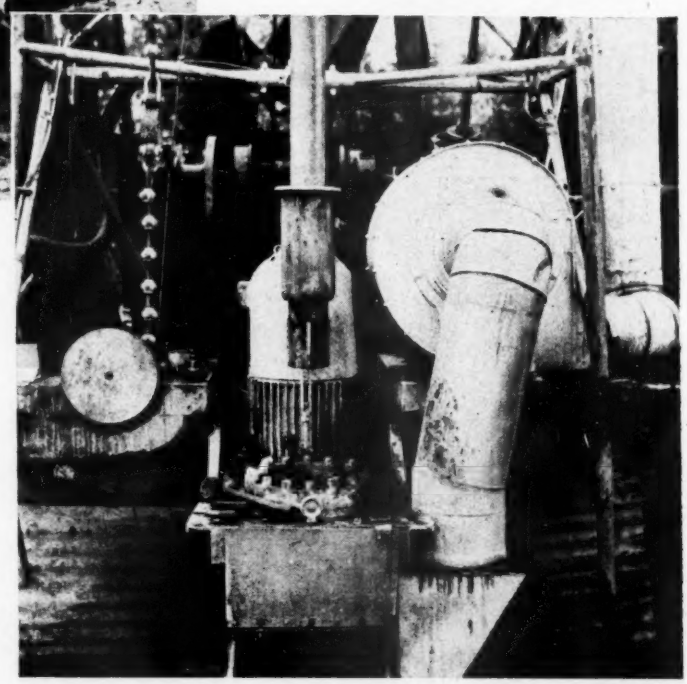
[1] For further details see "Research Evolves Clover-Leaf Burn," by C. W. Livingston, scheduled for publication in *E. & M. J.* early in 1947.

[2] For additional information see Alvin W. Knoerr, "Hard Iron Ore Yields to Fusion-Piercing," *E. & M. J.*, November, 1946, pp. 66-69. Also see page 59, MINING CONGRESS JOURNAL, January, 1947.

ing holes of similar diameter in this ore."

At present the field for fusion-piercing is in the drilling of hard ores in which the rate of penetration with the churn drill is low. The application of fusion-piercing to open-pit mining of ores other than iron is not anticipated at present. Early experiments were conducted on holes that were horizontal or inclined slightly downward. According to L. F. Granger, "One of the principal problems in the development of fusion-piercing has been the removal of slag from vertical holes where the assistance of gravity is not present as it is in horizontal holes." In all probability future progress will increase the rate of piercing, improve the efficiency of the equipment, and increase the depth to which holes may be fusion-pierced.





Above—A fusion-piercing test run under way. Note the expelled granulated slag.

Right—The exhaust gas collector at the end of the piercing blowpipe.

Secondary Breaking Receives Attention

The trend toward the use of large-diameter holes and increased hole spacing in open-pit mining, and the increased use of diamond drill blast holes in sublevel stoping and in stope preparation for other stoping methods has resulted in a reduced overall cost of breaking but an increased cost of secondary breaking. The increased cost of secondary breaking has been minimized by increasing the grizzly spacing, replacing grizzlies with box holes, using the slusher system to an increased extent in development for block caving, and by using larger haulage and crushing equipment. Two recent developments in the field of secondary breaking may further reduce costs and increase safety.

At the Pine Creek Mine, oversize boulders in scram drifts were drilled using a very light jackhammer and a ⅝-in. tungsten-carbide bit. According to Burwell, the small holes were drilled at a rate of approximately 30 in. per minute. The use of lightweight jackhammers reduced the work of the miner in drilling and at the same time increased drilling efficiency. The use of small powder charges in blasting reduced the volume of gases produced by the blast and reduced explosive consumption.

The use of "shaped charges" for secondary breaking is as yet in the experimental stage. Volla Torrey described the principle of the shaped charge and its application to military demolition in the July-August, 1945, issue of *Explosives Engineer*. John B. Huttle, in the May, 1946, issue of *Engineering and Mining Journal*, described the results of experiments directed by W. T. Warren and conducted by E. O. McAlister at the property of National Tunnel and Mines Company at Tooele, Utah. Professor Charles E. Munroe discovered the principle upon which the shaped charge is based.

Briefly, the principle is to direct the path of the detonation wave traveling through the explosive either to concentrate the explosive force at a point or to direct it as a beam. The detonation wave leaves the explosive traveling normal to the surface of the explosive. The explosive charge is shaped so that the detonation wave is "focused" on the concave side of the shaped charge and at a distance from the base of the charge known as the "stand-off distance."

Explosive consumption for blasting with shaped charges is less than for "plaster blasting." Experiments at Tooele using shaped charges so designed that the stand-off distance was about one-eighth of an inch indicate an explosive requirement of 1 lb. per

64 cu. ft. of garnetized, silicified limestone for charges constructed of 45 per cent strength gelatin.

Mucking, Loading, and Haulage—Trend Towards Mechanization

The trend in mine development has been toward concentrating and localizing the stoping area to control subsidence, reduce maintenance on extraction openings, improve ventilation and provide closer supervision. This trend, the increased use of mechanical equipment underground, and the trend toward large-scale operation have combined to present the industry with an underground traffic problem. The problem is individual to each mine.

To avoid "bottlenecks" all unit operations must be in balance. Perhaps progress in the immediate future in mucking, loading and haulage will be more a result of time and motion studies and of the economic selection of equipment to meet the time cycle, than the result of decisive improvement in the design of loading and haulage equipment.

The "Riddell shaft mucker" employing a clam-shell bucket has made record advances possible in sinking vertical shafts. The trend in sinking inclines is to the use of rocker-shovel-type loaders on inclines. The Eimco rocker-shovel with its patented snubber attachment has been successfully used on inclines up to 25 degrees. The conventionally rigged scraper slide has been successfully used on slopes up to 31 degrees.

A scraper slide rigged with a three-drum scraper hauler and using two drums as pull drums and the third drum as a haulback drum has been successfully used for scraping directly into a sinking skip in an incline up to 38 degrees. One pull rope passes underneath a hold-down sheave block on the footwall near one rib of the shaft. The haulback sheave block is placed in the face of the shaft near the opposite rib. The shaft round is blasted so as to throw the broken rock towards the rib on the side of the hold-down sheave block. The scraper load is picked up by scraping diagonally across the shaft using the hold-down sheave block and is then pulled in with the second pull rope after slacking-off on the rope first used. The digging angle of the scraper is increased to permit dumping at 38 degrees.

Loaders such as this have handled 300 tons of firebrick and slag in a day's work. This one is operating underground on limestone.

Joy Loader in Abrasive Rock

Progress in design of Joy Loaders for abrasive rock was delayed during the war. Recently, rock and ore model loaders have been developed using heavier designs throughout and using abrasive-resisting steel. The 11BU loader for the past year has been successfully handling 300 tons per day of firebrick and slag resulting from tearing down open-hearth furnaces at Farrell, Pa. The same model loader used in sinking a 15-degree incline, 8 ft. high by 22 ft. wide, in sedimentary rock made possible an average advance of 8 ft. per 8¼-hour shift. Loader operation was limited by hoisting capacity with a single three-ton mine car. The first loader and shuttle-car operation in iron ore will begin early in 1947. Joy loaders have been successfully used for several years in underground loading of limestone.

Exploration

Burrows[3] recently described an improved-design double-tube core barrel and "bottom discharge" diamond-drill bit. Circulating water is discharged at the cutting face of the bit rather than inside of the bit as in the low-waterway and the standard bit. The improved core-barrel design reduced abrasion of core within the core barrel. A new technique for coring highly soluble salts using a regular oil-filled rotary rig and a wire-line core barrel was described by Severy.[4] Experiments were conducted during the year with the diamond drill using non-coring bits for sampling and exploration. Cuttings were examined under the microscope as in oil-field practice.

Mine Ventilation

During the year a large number of mines began to use aluminum powder in preventing silicosis as a part of previously initiated programs for dust control, air conditioning and im-

[3] Burrows, L. J.—Improved Barrel and Bit Increases Core Recovery. *E. & M. J.*, Vol. 147, No. 11, November, 1946.

[4] Severly, C. Luther—Salts Cored Successfully With Oil-Field Equipment. *E. & M. J.*, August, 1946, pp. 85-87.

proved ventilation. Denny, Robson and Irwin [5] discovered in 1937 that the inhalation of aluminum powder was useful in preventing silicosis. McIntyre Research Limited, a nonprofit organization, obtained patents and in turn offered the use of the process to the world without compensation beyond that necessary to cover the cost of administration and to continue research. A. W. Jacob [6] described the method of administering the treatment.

Important Progress Made in Stoping Methods

Progress in sublevel stoping, square-set stoping and block caving has been most rapid. The development of the diamond drill for blasthole drilling has been largely responsible for increasing output in sublevel stoping, stope-and-pillar stoping, shrinkage stoping and stope preparation for block caving. Improvement in scraping, loading and haulage equipment and the wider use of time and motion studies and studies of the operating cycle, have increased output in all stoping methods.

Outstanding work has been accomplished by New Jersey Zinc Company at Gilman, Colo., in mining heavy ground. The development of the Gilman modification of Mitchell slice stoping, in which a 10-ft. cap is used as a core-girt and open-slice leads have been eliminated, has resulted in a substantially increased output per man shift.

Anaconda Copper Company at Butte, Mont., has led the way towards improvement in square-set stoping. Benefits of studies of the operating cycle have been most pronounced and have resulted in improvements which have nearly doubled the output per man shift.

The trends in square-set stoping are as follows:

1. From large blocks worked horizontally to smaller blocks worked vertically.
2. Elimination of shoveling and scraping in stopes where possible.
3. Introduction of wet fill.
4. Use of poorer-quality and smaller-size timber followed by filling.
5. Elimination of previously driven development raises, doing development work as an immediate preliminary to stoping, and using adjacent vertical slot from finished stope to serve the new stope.
6. Eliminating sills and sill-ties in all but soft, wet ground.
7. Making the operations of drilling and blasting, timbering, ore drawing and filling independent of each other if possible.
8. Breaking down the preestablished routine, wherein the set is considered to be the basis of the working cycle.

[5] Denny, J. J., Robson, W. D., and Irwin, D. A.—*Jour. Can. Med. Assn.*, Vol. 37, pp. 1-11, 1937.

[6] A. W. Jacob—The "Know-How" in Fighting Silicosis with Aluminum. *E. & M. J.*, Vol. 147, No. 3, pp. 70-75, March, 1946.

Block Caving Practice Is Directed Towards Handling Greater Tonnages

Progress in block caving is the result of experience and study by many mining companies. The trends in block caving are as follows:

1. To increase the height of blocks caved in one lift.
2. Towards the use of the slusher-drift system of development rather than the branch-raise system, except in very high blocks or in fine-breaking ores.
3. Towards the elimination of boundary cut-off drifts and boundary cut-off stopes, except in very strong ores, or in commencing caving on a new level or in a new orebody.
4. Towards the use of pillar-panel caving and the diagonal undercut so as to form a diagonal line of retreat continuous across adjacent panels.
5. Towards closer control and better integration of drawing and undercutting to increase fragmentation, reduce dilution, reduce maintenance on extraction openings and improve recovery.
6. Handling of larger-size particles and the use of box-holes rather than grizzlies.
7. Towards modification of the undercut pattern to increase the footage per machine-drill shift and to reduce the cost of ore broken in undercutting.

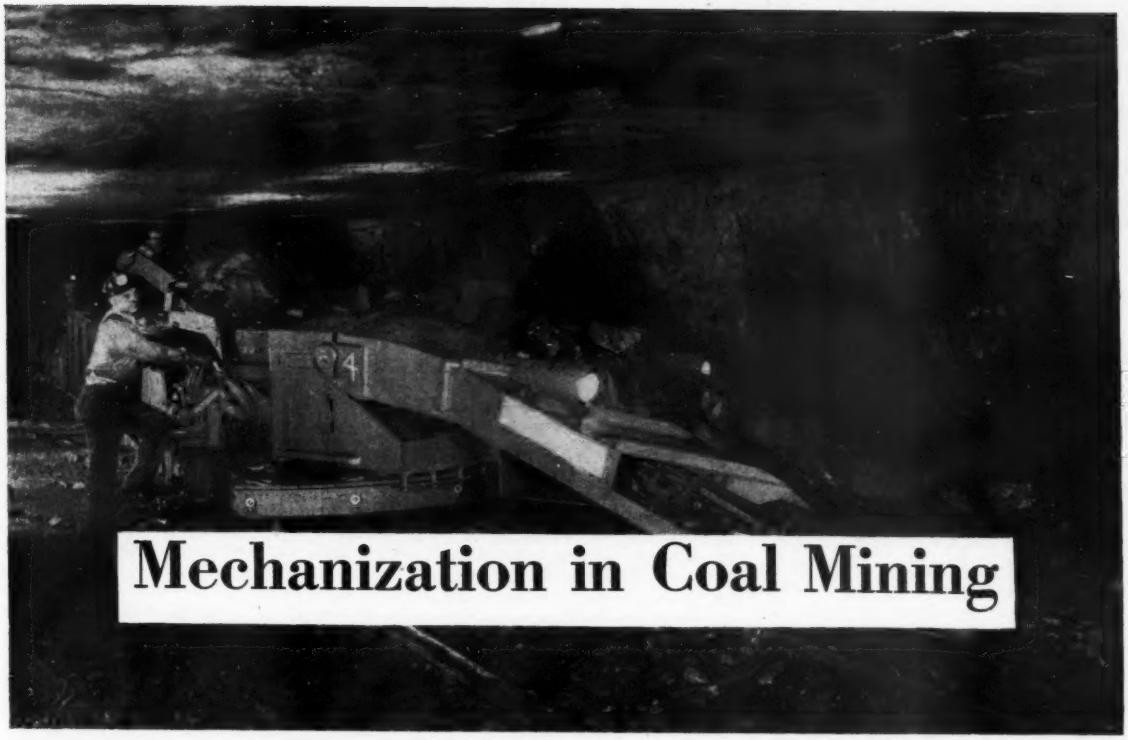
Professor Philip B. Buckey [7] of Columbia University School of Mines has proposed a new method of mining titled the "shrink-fill method." In shrink-fill stoping, work begins at the top of the orebody and progresses downward in lifts corresponding to the level interval. A slot is formed at the bottom of the stope, and the stope is advanced upward by radial drilling from suitably spaced raises driven to connect with the level above. Support is provided for the walls of the stope by keeping the stope filled with broken ore as in shrinkage stoping. However, the space between the upper surface of the broken ore and the back of the stope is reduced in strong ores and may be completely eliminated in weak ores to provide support for the back and to aid fragmentation. After the stope has been completed to the level above, waste-fill is added to the top of the broken-ore column at substantially the same rate as the broken ore is withdrawn from the stope, thereby leaving no open space in the stope and providing continuous support for the walls.

The method combines features of sublevel stoping, shrinkage stoping, cut-and-fill stoping and of the control of dilution in block caving. It may be used where surface subsidence must be prevented and is applicable to mining steeply dipping orebodies of moderate thickness and thick, flat-lying deposits under a wide range of cohesive strengths of ore and wall rocks.

"Progress in mining practice continues with faith that we may triumph not only over technical problems but also over the more difficult problems of human engineering. . . ."

[7] Philip B. Buckey—"The Shrink-Fill Method of Mining Ore," *The Explosives Engineer*, September-October, 1946, pp. 141-148.

The trend is towards the increased use of mechanical equipment underground.



Mechanization in Coal Mining

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By D. L. McELROY
Chief Engineer
Pittsburgh Consolidation Coal Co.

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TWO strikes, one of which was prolonged, in the entire coal industry combined with railroad car shortages in several producing districts made 1946 the second consecutive year that the country's coal production decreased in spite of a full market demand. Although mining equipment manufacturers continued shipments of new mining machinery in as great a volume as possible they were handicapped by some labor troubles and, as during the war, by shortages of steel and other materials. Final figures will probably show little if any increase in mechanical loaded production in 1946, due to the factors outlined above.

From an operating viewpoint the future of the coal industry must be built upon a firm foundation of lower mining costs. In 1946 these mining costs made a flimsy foundation on which to build. The only basic solution to this cost problem is greater production per man-hour. One of the important ways to improve the production per man-hour is through decreasing hand work by the increased use of efficient machinery. Increased mechanization of production coupled with more efficient management of all other phases of the industry is the only way in which maximum employment at maximum wages with a fair profit can be brought to the coal industry. Unless this can be accomplished, we will enter another long period of having a sick industry on our hands. This situation puts the problem squarely up to the manufacturers and the users of mining machinery so far as production costs are concerned.

Although considerable effort was made to bring out a number of new developments in mining machinery in 1946, there is no denying the fact that the results were below what was expected and hoped for at the beginning of the year. A survey of the various manufacturers of mining equipment, however, leaves no doubt that 1947 will see more new and improved mining machinery made available to the industry than any year since the war and probably more than any single year in the life of the coal industry. Much of this machinery will make its debut at the Mining Congress Coal Show in Cleveland in May.

The Ideal Machine Would Perform Many Functions

The Utopia of mining machinery, of course, would be one type of machine adaptable to all mining conditions and which would perform all of the mining operations now done at the face. The great variance of roof, seam, bottom and other natural conditions, along with some mechanical difficulties, have been too great to overcome, to date, to provide such a piece of equipment. That some such development will be made, there can be no doubt. The question is: how long will it take? Work on such machines as this type has been going on with varying degrees of effort for a number of years. The many "impossible" mechanical problems which were solved during the war in various industries should convince us

"Increased mechanization of production coupled with more efficient management of all other phases of the industry is the only way in which maximum employment at maximum wages with a fair profit can be brought to the coal industry."

that the answer need not be "too little and too late."

Although much greater speed is needed in the development and use of present and new mining machinery, the year 1946 was definitely one of considerable progress. An analysis of the various steps in the mining of coal brings out the progress made as well as indicating some of the things we can hope for in 1947.

Planning is an Important Factor in Mechanization

In spite of the fact that seam conditions cannot usually be changed to any extent it has been found that more careful planning of projections can often help a great deal to make the maximum use of the equipment at hand. Proper regard to working place centers, angle of work, making best roof material for top and grades can make a great difference in many mines in the efficiency and ease of timbering, tramming time, loadability, drainage, shooting and car-change time. Although in general the mining equipment must be adapted to the mining conditions, care-planning usually will save many a penny by giving the machinery a chance to perform at its peak.

Hand in hand with good planning goes the decision as to the number of men to work on the face crews. There are two distinct schools of thought on this factor and each can and does present good reasons for their conclusion. When the decision is made, however, then the planning as to layout of work and projections must be built around that system. Here again the mining or seam conditions have a very important bearing on the system to follow. Each side of this argument can present results that fully substantiate their use. There is probably no one answer to this question of crew size but it is expected that a full report will be made at the Mining Congress Coal Convention in Cleveland by experts in the use of each system.

Mining machinery cannot think and therefore the best of equipment will return results only in proportion to the intelligent planning used in the selection and use of the equipment.

The Timbering Machine Is Developed Past the Experimental Stage

Sufficient protection for the workmen is as important in mechanical mining as in any other type, and under some seam conditions more difficult to secure than under hand mining. The improvement in the accident record due to falls in mechanical mining as compared to hand mining has only been achieved by more attention to timbering under mechanical mining. Generally this has meant more timbering, particularly in the use of crossbars. This in turn has meant more work to do and more man-hours used for timbering.

The year of 1946 did see timber machines developed which materially improved the efficiency of timbering operations. Machines for timbering in both track and trackless mining were put into mines during the year. The use of these machines resulted in the timber work being done with from one to four less men than were used when timber was set by hand. One such machine had one electric motor from which hydraulic power was provided for tramming, sawing and placing of timber for the legs. This machine started on the section each shift with a trailing truck which held sufficient crossbars, posts, cap pieces and other supplies for the entire shift. These supply trucks were loaded outside at the yard and the timber was not handled again until used in the working place. Timbering machines still have some detail "bugs" to be eliminated but there can be no doubt that they are going to be widely used in future coal mining. They seem to find particular application in high production units.

Getting timber supplies to the face is as much or more of a problem than the actual timbering work. This is particularly true in thin seams and in trackless mining. During the year one mine ordered small trailer cars on tires which will be handled in the section by small rubber-tired, battery-powered trucks. These trailer cars will be loaded with timber and other supplies in the outside yard, run up on flat rail cars, transported to the sections where the battery-tired trucks will pull them into the faces. Here again the material will only be handled at the yard and at the face.

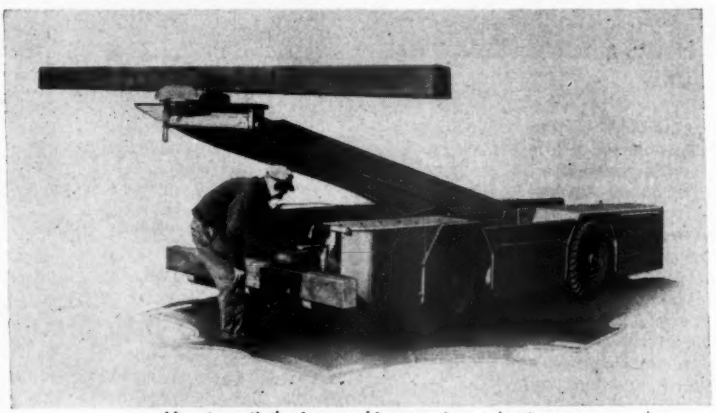
With the increased cost and scarcity of timber and the necessity for good roof control in pillar mining, the economical recovery of timber has become quite important. Several of the new timber recovery machines put in the mines in 1945 proved beyond a doubt their worth during 1946. Machines for this purpose in both track and trackless mining were used during the year. Some mines showed a net earning power in recovered timber as much as $50 per day plus the added advantage of better roof control.

New Cutting Machines Are on the Drafting Table

No major development in cutting equipment was made in 1946 but there should be several developments available in 1947 which were under way during the past year. Cutting is one of the most important and difficult jobs in the mining of coal, particularly so where "full seam" mining is done and some of the cutting must be done in slate. A number of mines have developed the other face jobs until cutting is the production bottleneck.

The use of alloy bits was greatly extended during 1946 although considerable experimental work still needs to be done. In difficult cutting on high production units the time required to set bits can peg production and the use of alloy tipped bits has been much more efficient under such conditions.

The further use of bug-dusters on shortwall machines during the past year definitely established this development as most important. In many cases it has meant the saving of one man-shift on conveyor work. In mines which require universal cutting machine capacity but cut on the bottom, there has been a serious need of bug-dusters on the machines. Several types were made and tried during the past year, but none proved adequate for the job. Two new types were put in the mines the latter part of 1946 which showed much promise.



New type timbering machine now in production.

If they prove successful, they will not only give better loadability due to the better bug-dusting but will eliminate hand labor and in some cases may provide the means of not requiring shear cuts in some seams. This will increase materially the cutting capacity of the machines in these mines.

Plans started by manufacturers in 1946 should bring out this year some cutting machines which will be more simple in construction, more rugged and of greater capacity. Cutting machines with these qualities are badly needed as maintenance costs and out of service time are both too high for present-day mining.

Mobile Drilling Machines Installed

Nothing new of major importance in shooting technique or materials was developed during the past year but drilling did make some progress. Mechanical loading of coal has generally made drilling a two-man job or put the work on the cutting crews. With high-tonnage units the cutting crews do not have the time to do the drilling with the result that two-man hand-held drills or post drills have been used. Although a mobile drilling unit is much larger and more expensive than a hand drill, it is economical if it is designed so that one man can operate the machine and do the necessary drilling. Work on such machines was progressed during 1946 to the point where several were installed that proved generally satisfactory. One such unit was hydraulically operated, mobile and had capacity to do more drilling than previously was done by two men. For safety the drill switch was so located that the operator could not touch the drill auger or the thread bar without releasing the switch which stopped the drill. Such units were developed for both track and trackless mining and with some improvements in details should be accepted in many conditions during the coming year.

Another development looked forward to during the coming year is a light hand drill with a hydraulic motor, which will be powered from the cutting machine in conveyor work.

Where the cycle of operation and the distribution of manpower made it feasible, some operators were planning on combining the timbering and drilling operations into one unit and one machine. In some cases this would eliminate one machine on the section and also possibly a man-shift of work.

Loading Machines Have Reached a High Degree of Effectiveness

As stated before, the eventual development of a satisfactory machine to do all the face operations will be the ultimate in loading machines; at least until the day when a method is found to utilize the coal's energy without removing it from the ground. In mobile loading, there were no new developments during 1946. As in all types of loading equipment, the only restraint on their use was the ability of the manufacturers to deliver them. Another article on this issue reviews the number of loading machines of various types which were shipped in 1946. All of the mobile loaders on the market today have more loading capacity than the amount of coal which can be prepared for them by present-day methods. The immediate need is more efficient timbering, drilling, cutting and transportation.

In thin-seam work the power duckbill loader proved its place during 1946. In a number of cases this equipment loaded more coal with 50 to 25 per cent less manpower than under older methods. This type machine along with bug-dusters on cutting machines, using a three-man crew, has loaded from 50 to 100 tons per shift with less real work than former conveyor systems.

A low-seam rubber-mounted loader with a retractable conveyor for loading on to belt, chain or shaking conveyors was developed to the point that it was put into manufacturing production the latter part of the year. This machine was thoroughly tried underground, and a number of them will go into production of coal in 1947. Such a machine should materially increase the loading rate at the face in thin-seam coal with a consequent increase in tons per man-hour. Plans are in the minds of some mining men to expand the principle of this machine into a higher capacity unit for thicker seams.

In conveyor work one of the more difficult problems to overcome is the difficulty of moving the equipment from one working location to another. One manufacturer has designed a small cat-mounted truck for this purpose as well as a general utility truck in conveyor work. Others are working on the principle of mounting the drive units on a truck which would be powered from the present power source of the equipment. There is little doubt that a satisfactory solution to this problem will be found during the coming year.

During 1946 mobile loaders continued to be used more in the thinner seams. The development of low mobile loaders over the past few years with their higher loading rates has made them attractive in many instances. Here again the higher loading rates have increased the need for more efficient preparation of the faces and better transportation from the machine.

"Plans started by manufacturers in 1946 should bring out this year some cutting machines which will be more simple in construction, more rugged and of greater capacity."

Work Being Done on Prefabricated Track

There was nothing new of importance in track work or equipment during 1946 except the continued scarcity of steel. There has been much discussion and some work on developing prefabricated track for mobile loading sections, but to date most of the systems have been too complicated and involved too many parts. Another drawback to the use of such track has been the lack of uniform driving of places, a great deal of which is due to avoiding natural bad conditions. Work is being done on making simpler prefabricated track layouts, which it is hoped will be acceptable.

Coal companies developed several track-cleaning machines during the year. Although a few did a reasonable job of track cleaning, the right machine, which most companies are looking for, has not yet been made. The greatest saving in track cleaning probably lies in preventive measures such as tight cars, proper loading in the sections and good cleanups in the faces.

Haulage Distances Are Increasing

With better track, larger cars and higher speeds, mine transportation continued to improve during 1946. Haulage distances on main lines are generally getting longer, but this is one place in mining where equipment improvements have been able, in general, to keep up with the rising labor rates.

The use of shuttle cars in trackless mining continued to increase during the past year, and under the proper conditions and planning made some very notable records as a means of section haulage. In spite of the troubles of trailing cables, the trend seemed to be towards cable-reel cars. Improvements were made in details of shuttle cars, but no new designs of major importance came out in 1946.

The use of the elevated discharge on shuttle cars to stack slate in working places has been a very economical development in many mines with the drawback, however, of excessive maintenance due to handling the heavier, larger and more abrasive rock. There were, however, some new designs on the drawing boards which will make their appearance at the mines during 1947. There is little doubt that the present year will see more progress in shuttle car equipment than any year since the war.

Today's Trend Is Toward Larger Mine Cars

It is estimated that about 2,000 mine cars of 8-ton capacity or more were put into the coal mines during the past year and that perhaps twice that number will be delivered during 1947. These data indicate a very definite trend towards larger mine cars. Most of the cars are of eight-wheel type, but not all, as a number of large-capacity cars with four wheels were made. Although large cars give the maximum benefit where mobile loading is done, they offer very definite saving in transportation alone and are thus desirable even when shuttle car or belt-loaded. A few mines which have only main line track and load cars by belt from the side are considering mine cars up to over 20 ft. in length.

There was a very definite trend to the use of specially-built man-trip cars during 1946. The number put into use was limited only by the ability to secure delivery of them. These cars have demonstrated that they furnish safer and faster hauling of men to their work, both of which are quite important under portal-to-portal pay. They are also the most comfortable means of riding to work that the miner has ever had. Such cars were used for years at some outside tramroad hauls but only in the last two years have they been generally accepted by the industry for underground transportation of men.

Speed Is Being Increased on Locomotives

More of the so-called high-speed locomotives were delivered in 1946 than any year to date. Two manufacturers delivered units which were rated at 25 miles per hour or better at full load. In some cases the extra speed over long hauls allowed the number of units required to be reduced by 60 per cent. All of these locomotives were easier riding than older types and should materially reduce track maintenance. There can be no doubt that with present car, locomotive and track equipment that "railroading" is on its way into the coal mines.

With advent of the large mine cars, the older types of gathering locomotives have proved too light and inadequate for efficient haulage. Several new types of 8 to 10-ton locomotives designed for both gathering and swing service were delivered in 1946. These units have the power and flexibility to give the maximum service to mechanical mining and their performance will be closely watched.

A few mines went to battery, gasoline or diesel locomotives for yard work on the outside in order to eliminate the danger and inconvenience to other equipment of having trolley wire in the yards.

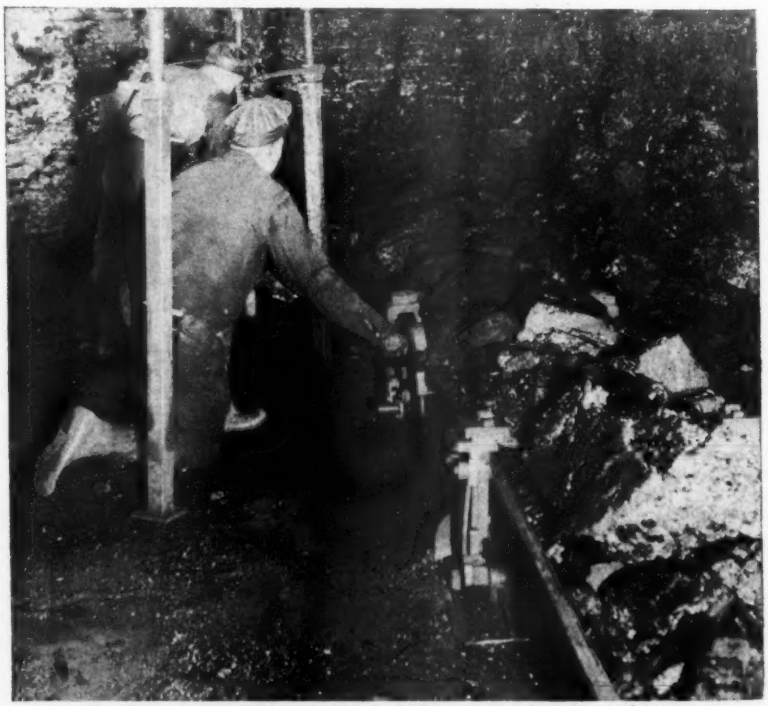
Conveyors Being Applied to Thicker Seams

The use of conveyors as a means of transportation continued to expand during the past year. Although at first accepted in the thinner seams due to reducing rock work to obtain height, conveyors for haulage are finding more and more acceptance in the thicker seams. An increased number of mining systems are being laid out and put into use which have the loading machines discharging onto some type of conveyor. Also a number of new coal areas at mines were laid out for conveyor haulage to bring the coal to the main-line haulage tracks. Work has started during the year by some manufacturers on making up portable belt units which would enable belt haulage to be taken much closer to the face than it had ever been successfully used before. Shaker pan lines of a size to handle 100 tons per hour were developed in 1946 and some were being installed as transportation units behind loading machines. The same need of portable drive units for shaking conveyors mentioned above exists for all conveyors, particularly the closer the face that they are used.

Maintenance Is a Key to Successful Operation

A study of the cost sheet of any mechanical mine immediately points out the importance of maintenance. It is to be expected that the more machinery that is used in coal mining the more money that will be spent on maintenance; but, this in turn means that more effort must be spent by the manufacturer in developing the best possible machine for the job and for the operator to develop the best system of maintaining the machinery after it is on the job.

In addition to the normal central overhauling shops and the mine repair shops, a number of companies have designed special cars which are equipped with many of the tools and parts which are required for face maintenance. These cars are either moved to the section with a mechanic as needed or are placed on the section and remain there as long as the section is in production. The same system is also used at a number of



Face preparation should balance the high capacity of stationary loaders.

mines in the form of greasing cars. There are many systems used in mine maintenance, and each operation must study their problems and work out the most economical way of handling them.

During the war it was impossible for the mining machinery manufacturer to get the types of steel and other materials going into his equipment that the service required, but with the return to normalcy, these materials are becoming available, and they are putting them into their equipment as fast as possible. Also, many of the new materials developed during the war will find uses in mining machines and should make the maintenance of them less costly. The closest cooperation between the manufacturer and the operator must be continued in order to keep the cost of equipment maintenance to the lowest possible figure. Before the war several makers of mining machinery worked with the operators and their mechanics in developing training programs in the proper maintenance and care of the equipment. Such programs are again being organized and will certainly react to the advantage of both makers and users of the machines.

Management—Its Function and Duties

In the final analysis the responsibility for properly equipping a mine, organizing and training the labor force to efficiently operate and maintain it, rests with management. In spite of the placing of the responsibility on the management, where it belongs, the necessary results will not be achieved unless the operators and the manufacturers of mining equipment continue to work closely together; in fact, more closely than ever. On this cooperation of management, manufacturers and working force depends the future of the industry, for only by the full efforts of all can the increased productivity per man be increased; and only by increasing production per man-hour can costs be kept competitive with oil, gas and water power.

Safety in Mining

By S. H. ASH
Chief, Safety Division
Bureau of Mines

IT is necessary to utilize statistics to show whether or not safety in the mineral industry improved during 1946.

Statistics on injuries during the calendar year 1946 are tentative because only approximate figures for fatal injuries are available. The trend of the frequency of fatal injuries (on a man-hour-exposure basis) in any industry indicates a reliable trend of the severity of injuries in that industry. The statistics show that progress is being made in the prevention of accidents in the mineral industry as well as in its different branches.

The psychological reaction in the mind of the general public to the current situation concerning the hazards to persons employed in mining, particularly in coal mining, cannot be swept away by merely calling attention to favorable statistics. However, statistics on accidents in mining are important. They show more safety in all branches of mining, not less. Of more importance, however, they show a trend downward in the fatal-injury rates for the period 1931 to 1946 and a larger increase downward in these trends for the past five years.

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"An analysis of the data on injuries in mines shows that mechanical mining has played an important part in creating conditions whereby iniury rates have been reduced."

Method to Determine Fatal-Injury Record for 1946

The trends of the fatal-injury rates (killed per million man-hours) both in the mineral industry and in its various branches are shown graphically in Figures 1 to 4 inclusive.

The general trends of the fatal-injury rates are determined by the method of least squares for the periods 1931-45 and 1941-45. This method is used because of its utility for predictions and application to determine the fatal-injury rates for 1946.

The trends of the fatal-injury rates are also determined by the method of moving averages, by five-year moving averages, for the period 1931-45. Five-year moving averages have been used because actuarial studies indicate that at least five years' experience, regardless of the number of persons employed, is necessary before a reliable injury rate can be calculated for a job or for an industry; rather significantly, it also takes that long to accomplish an efficient accident-prevention program.

Although the method of moving averages is useless for predictions, it is significant in that when the curve flattens and coincides with the general trend (see quarries, Figs. 1 and 2), the situation regarding means to prevent accidents has been reached whereby something different from normal must be accomplished to effect a reduction in injury rates. The slopes of the trends of fatal injuries for all branches of the mineral industry, except quarries, during the above-mentioned periods, indicate that further reduction in fatal-injury rates can be anticipated and should be realized.

The Fatal-Injury Rates in the Mineral Industry

Tentative figures indicate that 1,185 persons were killed in the mineral industry during 1946 as compared with 1,285 during 1945. The fatal-injury rate for 1946 is estimated as 0.91 per million man-hours, the lowest in the history of the industry, as compared with 0.93 for 1945. (See Figs. 1 and 2.)

Coal Mining

As coal mining contributes approximately 85 per cent of the man-hours of exposure of persons employed in the mineral industry, any change in the fatal-injury rate or severity of injuries for coal mining materially affects the corresponding factors for the mineral industry.

In any discussion on injury rates in coal mining, criticism can be directed against the method of showing injury rates on a tonnage basis. Nevertheless, the reduction in injury rates on this basis definitely shows that the Nation's coal is being mined with less loss of life.

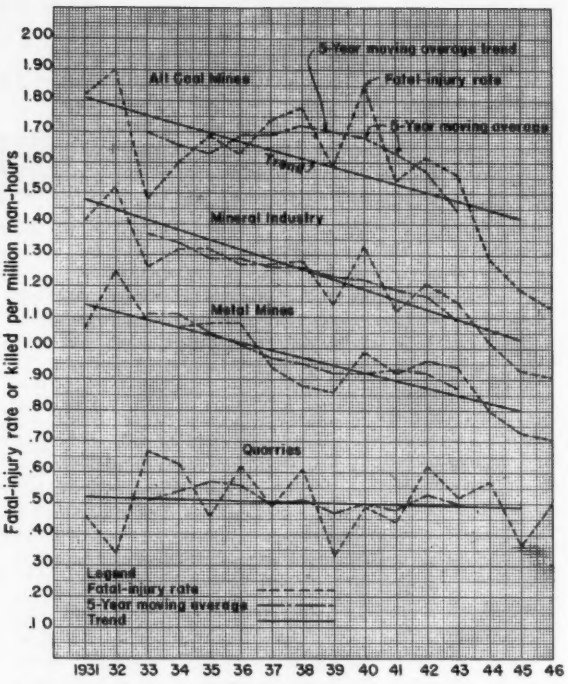

Figure 1—Fatal-injury rates and trends for Mineral Industry and some of its branches for years 1931-45 and fatal-injury rates for 1946.

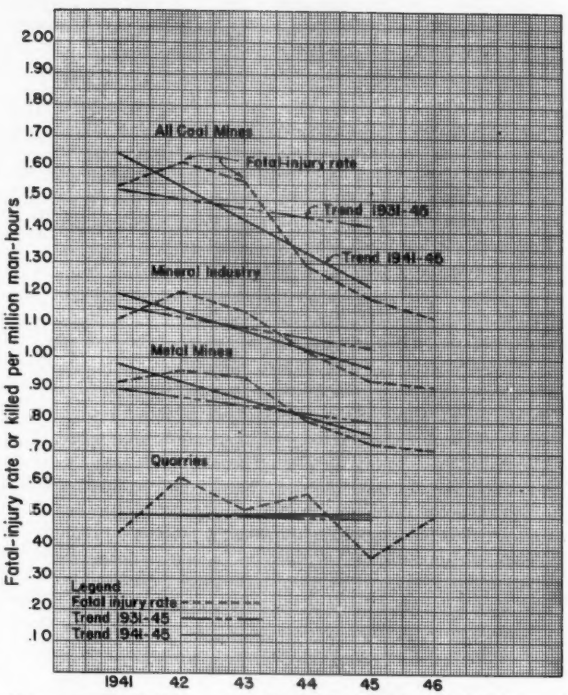

Figure 2—Fatal-injury rates and trends for Mineral Industry and some of its branches for years 1941-45, fatal-injury rates for 1946, and trends for years 1931-45.

It must be recognized that reliable production figures can be obtained on coal, whereas data on man-hours of exposure must be projected for many mines. This, however, is not an excuse for indefinitely continuing the tonnage method as the yardstick of injury rates.

The coal-mine worker derives relatively little satisfaction or enthusiasm from knowing that he is producing more when he believes that his life expectancy in working in his industry remains the same or is worse than in the past. The presentation of statistics on a man-hour-exposure basis is necessary to remove the impression that, although tonnage in coal mining is being increased, accident rates may also be increasing.

Despite any impression to the contrary, coal mining has been growing progressively safer. Neither the industry nor the agencies (Federal and State) concerned with promoting safety smugly cite the fatal-injury rates; however, tentative figures indicate that 974 persons were killed in coal mining during 1946 as compared with 1,079 during 1945. The fatal-injury rate per million man-hours is estimated as 1.13 for 1946, an all-time low, as compared with 1.19 for 1945. The fatal-injury rate on a tonnage basis (per million tons) is estimated as 1.64 for 1946, an all-time low, as compared with 1.71 for 1945.

Fatal-injury rates on a man-hour-exposure basis indicate that anthracite mining is safer than bituminous-coal mining. (See Figs. 3 and 4.)

Thirty-one persons were killed by explosions of gas or gas and dust during 1946 as compared with 78 during 1945. Thirty of these lives were lost in bituminous mines and one in the anthracite mines during 1946.

Bituminous-Coal Mining

Because employment in bituminous-coal mining composes approximately 70 per cent of the man-hours of exposure for the mineral industry, the fatal-injury rate at bituminous-coal mines materially affects the fatal-injury rate and severity rate of injuries for the mineral industry.

Tentative figures indicate that 800 persons were killed in bituminous-coal mining during 1946, as compared with 936 during 1945. The fatal-injury rate for 1946 is estimated as 1.14 killed per million man-hours, or 1.52 killed per million tons, as compared with 1.23 and 1.63, respectively, for 1945. The estimated fatal-injury rate for 1946 is an all-time low. This is primarily because of a reduction in the combined total fatal-injury rates from the three principal causes of injuries, i.e., from falls of rock or coal, haulage, and explosions of gas or gas and dust. The following table summarizes data on fatal injuries by the foregoing causes.

Anthracite Mining

Tentative figures indicate that 174 persons were killed in anthracite mining during 1946, as compared with 143 during 1945. The fatal-injury rate for 1946 is estimated as 1.09 killed per million man-hours, or 2.85

NUMBER OF FATAL INJURIES AND FATAL-INJURY RATES FROM FALLS, HAULAGE, AND EXPLOSIONS OF GAS OR GAS AND DUST, BITUMINOUS-COAL MINING, 1942-46

Cause	Year and Number Killed				
	1942	1943	1944	1945	1946
Falls of rock or coal	592	593	590	462	445
Haulage	241	227	236	208	164
Explosions (gas or dust)	148	166	33	73	30
	Number Killed Per Million Man-hours				
Falls of rock or coal	0.953	0.969	0.703	0.606	0.637
Haulage	0.388	0.372	0.281	0.273	0.235
Explosions (gas or dust)	0.238	0.272	0.039	0.096	0.043
Total	1.579	1.613	1.023	0.975	0.915

killed per million tons mined, as compared with 1.00 and 2.63, respectively, for 1945. The estimated rate for 1946 is more than that for both 1944 and 1945 but is better than for any year preceding 1944.

Although the fatal-injury rate per million man-hours for anthracite mining during 1946 is better than that for bituminous mining, the trend appears to be upward and indicates that something detrimental has been affecting safety in anthracite mining in 1946. (See Figs. 1 to 4.)

Metal Mining

Tentative figures indicate that 87 persons were killed in metal mining during 1946 as compared with 104 during 1945. The fatal-injury rate for 1946 must be determined from the trend of past years and is estimated as 0.71 killed per million man-hours as compared with 0.73 in 1945. The estimated rate for 1946, if correct, is the lowest rate so far attained in metal mining. The indications are that fatal-injury rates are leveling off; and if slack work becomes more common and if the number of small underground mines increases, safety work must be more effective in these groups than it was before the war if the accident rates are not to become worse.

There were no disasters or lives lost by fires during 1946, in metal mining.

Quarrying

Of the major branches of the mineral industry, quarrying has maintained the best safety record during the past 15 years.

The general trend of the fatal-injury rate in quarrying during this period is approximately level. The moving averages show a definite series of approximately 5-year cycles, and the trend passes alternately above and below a fatal-injury rate of 0.5 killed per million man-hours.

The general trend during the period 1941-45 is slightly upward, whereas the trend during 1942-46 is downward.

Tentative figures indicate that 45 persons were killed during 1946 as compared with 48 during 1945. The fatal-injury rate for 1946 must be determined from the trend of past years and is estimated as 0.50 killed per million man-hours as compared with 0.37 in 1945. It appears that quarrying has reached a situation in its accident-prevention program where the injury rates are with difficulty kept in line; and under existent conditions it appears that an average fatal-injury rate is 1 life lost for every 2 million man-hours worked. To improve or even maintain this rate, constant effort is necessary to maintain safety-mindedness and safe conduct in the individual workman.

No disasters occurred in quarrying during 1946.

Discussion of Fatal-Injury Rates

By comparing the record of fatal-injury rates in the various branches of the mineral industry during the period 1941-46, an improvement is shown, notwithstanding the fact that all previous production records were broken in an effort to meet unprecedented war and reconversion needs.

Under normal or usual operating conditions, a drive to increase production usually results in increased accidents; however, during the foregoing years such was not the result.

The improvement is a result of many factors, of which a major one is the cooperation on the part of both those engaged in producing the Nation's minerals and those engaged in promoting safety. However, the word "cooperation," which is essential under any circumstances, does not ex-

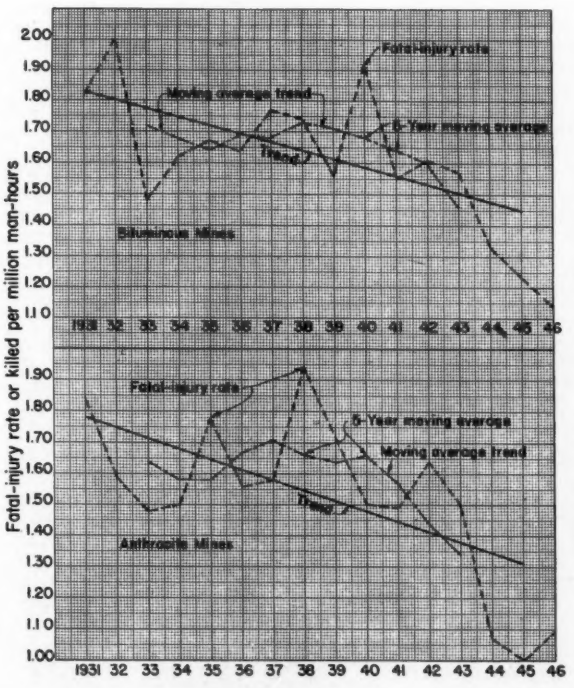

Figure 3—Fatal-injury rates and trends for Coal-Mining Branch of Mineral Industry for years 1931-45 and fatal-injury rates for 1946.

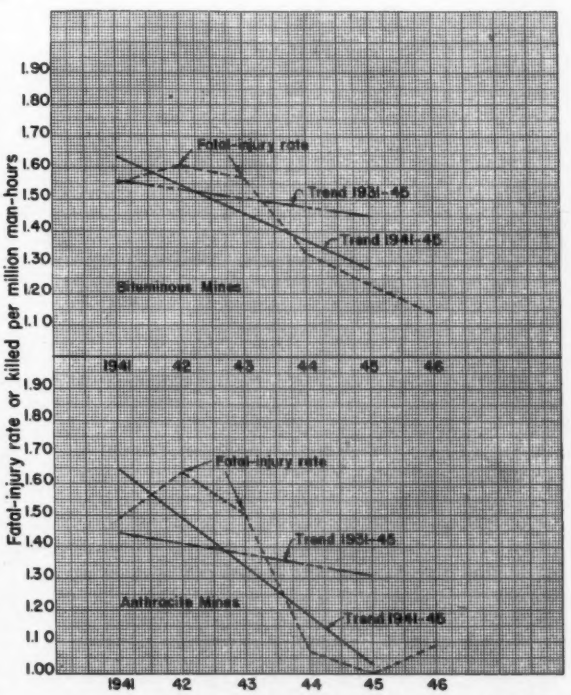

Figure 4—Fatal-injury rates and trends for Coal-Mining Branch of Mineral Industry for years 1941-45, fatal-injury rates for 1946, and trends for years 1931-45.

plain the measures that must be taken if progress in safety is to be continued.

Factors That Affect Fatal-Injury Rates

Management, safety directors, and the workers' representatives should analyze both the statistics and the injury rates and direct procedures aimed to prevent accidents that result in injuries.

The fact that the over-all fatal-injury rate is downward gives deep satisfaction to all concerned, but it does not place the finger on where improvement can or must be made.

The largest proportion (approximately 50 per cent in coal mines, 35 per cent in metal mines, and 31 per cent in open-cut mines) of fatal injuries in the mining branches of the mineral industry is attributable to falls or slides of rock or ground. It is not for this reason that inspection agencies (Federal or State) were created, nor is it for this reason that the "prodding" they receive nor the funds by which they exist are given. Disasters, which occur from time to time, arouse public opinion to demand that something be done to prevent them. Disasters, such as mine explosions and fires, are the worst offenders and the most inexcusable mine accidents.

As 50 per cent of the persons killed in mining are killed in the coal-mining branches of the mineral industry, an indicated slight but consistent improvement in the fatal-injury rates from falls of roof or coal in the years 1941-46, over previous periods, is effecting a reduction in the over-all rate of fatal injuries in the mineral industry.

The second major cause of accidents in all kinds of mines has been haulage. It is by the prevention of haulage accidents in all branches of the mineral industry that a reduction in the fatal-injury rate for haulage accidents in the mineral industry is being accomplished. Replacement of rail haulage by conveyors, trucks, and shuttle cars appears to provide safer transportation in mining.

The third major cause of coal-mine fatalities for the past 30 years has been explosions of gas and gas and dust. Before 1916, explosions occupied second place as a cause for deaths in coal mines. A reduction in the fatal-injury rate from explosions since that time has been achieved. The Bureau of Mines can justly claim a share of the credit, because its investigations and field activities have resulted in the development and use of permissible explosives, permissible mining equipment, safer trailing cables, improved gas-detecting devices, improved ventilating practices, and more widespread use of rock dust.

However, the trend of the fatal-injury rates from explosions has been upward for the past decade. Although deaths from explosions have accounted for less than 10 per cent of the fatalities from all causes in coal mines (3½ per cent in 1946); nevertheless, they have contributed much toward retarding a larger favorable reduction in the over-all rate of deaths underground in bituminous coal mines.

Because the prevention of mine explosions is a matter that depends primarily on the working environment (as affected by ventilation and coal dust) of the miner and on the equipment by which coal is mined and transported, management can do more to prevent mine explosions than any other group or individual concerned with coal mining.

A steady decrease in the fatal-injury rates from explosives and electricity has resulted in recent years. The use of explosives and electricity in mining is intimately linked with mechanization, and both contribute much toward accidents that are assigned to explosions, fires, and falls of roof. A decrease in accidents by explosives reflects itself in a decrease in accidents from falls of roof and explosions. A decade ago they accounted for as many deaths as now result from explosions. An increase in the production cut by machinery, and obtained from strip pits or open pits, has reduced blasting hazards.

"Despite any impression to the contrary, coal mining has been growing progressively safer."

An analysis of the data on injuries in mines shows that mechanical mining has played an important part in creating conditions whereby injury rates have been reduced.

The amount of coal mined and loaded by hand has decreased over 50 per cent during the past decade. The amount shot from the solid has decreased slightly. The increase in coal production since 1944, has been obtained largely from strip pits.

The production of mineral products from open-cut mining (both coal and non-coal) has increased during the past decade. The employment in open-cut mining is favorably affecting the fatal-accident rates.

The fatal-injury rate in open-cut mining in the non-coal branches is upward, whereas it is decreasing in the coal-mining branch.

An important factor contributing to the over-all fatal-accident rate is the fatal-injury rate of persons employed on the surface, other than those engaged in open-cut mining. As electrical and mechanical equipment for mining, loading, transportation, and preparation increases, the maintenance of this equipment requires an increase in the man-hours of exposure classified as surface employment.

An analysis of data on fatal injuries shows that the gains in the over-all fatal-injury rate have been affected favorably by employment in open-cut mining and other surface work.

It is obvious that if all minerals were mined in strip pits or by open-cut mining, the fatality rate would be less than if the same tonnage were obtained by underground mining. The injury rate for all branches of the mineral industry would be approximately 0.5 killed per million man-hours.

The improvement of safety in the mineral industry lies with the industry itself. This can be done by giving the small-mine group the same attention in safety education, inspection, and enforcement as is required at larger mines. If this is not done, an increase in fatal-injury rates is inevitable; for example, in 1942 there were 6,185 underground bituminous-coal mines, employing 361,061 persons, among which 1,143 lost their lives; 5,069 of these mines employed 78,516 persons, among which 271 lost their lives. This group of so-called small mines employed but 15 men each and produced 63,043,226 tons of coal. They represent the second largest group of mines, produced less than 100,000 tons of coal yearly to each mine, and killed 271 persons as compared with 297 killed at the group mines producing 250,000 to 600,000 tons yearly.

The same conditions and remedies apply to metal mines. As a group the small metal mines that were closed during the war contributed many fatal injuries during past years.

The leasing system as applied to metal mining always has a detrimental effect on accident prevention in metal mining if the lessors do not come under the safety acts, or are unskilled workmen, or are not amenable to safety regulations of a larger organization. An increase in the number of prospects and small partnership operations will contribute to an increase in accidents and injury rates.

The Latest Developments in Ore Dressing

By S. R. ZIMMERLEY

Chief, Salt Lake City Division
Metallurgical Branch, Bureau of Mines
U. S. Department of the Interior

The Extension of Our Domestic Metal Reserves Is Directly Dependent on New Methods of Beneficiation. Research in the Milling of Low-Grade Ores Continues to Be of Utmost Importance to the Metals Industry

IN a recent article E. H. Rose, Chairman of the Milling Committee of the A. I. M. E., has surveyed the general subject of new developments in milling in a comprehensive manner and has assembled several hundred references to the subject. It seemed advisable, therefore, to limit the field of the present article to a few subjects of general interest which represent trends in milling practice or which, upon further development, may result in advances in practice of mineral beneficiation.

New Methods of Concentration Applied to Low-Grade Materials

The increasing cost of underground mining and the scarcity of experienced miners has led operators to search for mill feeds that are readily obtainable at low cost. Mine dumps and tailings dumps constitute such material. Current practice in the Coeur d'Alene mining district, where more than half the feed to the mills producing lead and zinc concentrates now originates from dumps and tailings, is an example of this trend.

Workable dump materials are limited in amount and will probably be worked out in the near future. The methods of concentration to be discussed, however, also may be applicable to placer sands and other low-grade materials. An important possible application is for preliminary concentration of ore from deposits of such limited size and grade as not to warrant the construction of large-scale flotation plants; the less expensive preliminary concentrator could be operated at the property and the concentrates shipped to conveniently located existing mills for final treatment. Moreover, it might be possible in some instances to reduce overall costs by using lower cost, less selective, underground mining methods and subsequently rejecting the extra diluent material by one of these inexpensive preliminary concentration methods.

Heavy Media Methods Are Attracting Widespread Attention

Several sink-float processes are in general use. Coarse ore, usually plus six-mesh, is introduced into a cone that contains a heavy medium consisting of an aqueous suspension of finely divided ferrosilicon, magnetite or galena; the light gangue particles rise and the heavier mineralized particles sink. The float product is a finished tailing and is discarded. For non-ferrous ores the sink product is usually a rougher concentrate which after fine grinding is retreated by flotation.

Recently, favorable results have been obtained in large-scale tests wherein a modified Akins classifier has been employed as the separating vessel for sink-float concentration. The spiral of the classifier removes the sink product and the original design of the spiral lifting device permits raising the spiral and shutting down the separator without the necessity of draining the vessel.

Much thought has been given to the problem of treating sizes somewhat finer than six-mesh by heavy-media processes. Inherent factors such as slow settling rates of fine

New ore dressing methods are receiving continued attention.

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particles through a viscous medium, the increased cost of screening at finer sizes, and difficulties of medium recovery limit the lower size range that can be treated economically.

In addition to the well known applications of sink-float to treatment of iron ores in the Iron Range and lead and zinc ores in the Coeur d'Alene and Tri-State districts, the process is employed to concentrate tin ores in Bolivia and garnet and magnesite ores in this country. Pilot plant tests have shown that the process can effectively beneficiate various fluorite, manganese, copper-tungsten and tin-tungsten ores.

Humphreys Spiral Classifier Treating Wide Variety of Ores

The Humphreys Spiral is one of the simplest continuously operating mechanical devices employed in the concentration of minerals. In operation it has no moving parts and uses no power. The pulp, usually minus 10-mesh, flows down a spiral launder, and the heavier ore particles are drawn off through ports on the inner side. By splitting the tailing as it flows from the spiral, it is possible to separate sand and slime and also to make a middling product for recirculation or separate treatment. The concentrate from the rougher spiral may be further enriched by retreatment in cleaner spirals or by flotation. The simple construction and absence of moving parts make the spiral itself an inexpensive device to construct, operate and maintain.

The first large-scale operation treating dump material containing zinc-lead-silver is that of the Pacific Bridge Company at Park City, Utah. Following considerable test work at the Bureau of Mines laboratory at Salt Lake City, construction was started in the late spring of 1946, and 12 weeks later the first car of zinc concentrates was ready for shipment. Fifteen hundred tons of minus 10-mesh tailings per day is put through 48 spirals. The concentrate is reground and subsequently treated by flotation to produce zinc and lead concentrates, the zinc concentrates assaying more than 60 per cent zinc. It is of interest that these dumps of known metal content have existed for many years in an active mining district and were not considered worthy of treatment even under the stimulus of war demands until the spiral method of preliminary concentration was investigated.

The spiral has found commercial application in the concentration of chromite, rutile and ilmenite from beach sands and in the washing of coal. Other possible applications include the treatment of iron. tantalite, columbite and tin ores, tailings from gravity and flotation plants, and placer deposits containing gold, silver, corundum, garnet, monazite, zircon or other heavy minerals.

Two New Concentrators Have Interesting Possibilities

The selective media concentrator, recently developed by the Stearns-Rogers Manufacturing Company, differs from sink-float devices in that the ore itself forms the medium, and it can treat much finer ore than is usually treated in the sink-float machine. Experimental application to the concentration of iron ore has been very promising, and a broad application to the beneficiation of low-grade non-ferrous ores is indicated.

Recently Coghill and others have published the results of a detailed study of the hydraulic constriction plate-type classifier. As a result of this study, Coghill has evolved a hydraulic classifier which is not only an improved classifier but which, when fed with prepared material, acts as an efficient concentrator.

Automatic Controls Feature Advances in Grinding and Classification Methods

The trend toward mechanization and automatic control of grinding and classification is most evident in the mills treating porphyry copper ores. Because of the large tonnages milled, cost factors that appear infinitesimally small per ton assume important over-all proportions and demand careful consideration.

The Utah Copper Company has developed many of these controls. For example, a control system patented by H. E. Wurzbach automatically regulates the feed to the crushing rolls circuit so that this circuit always operates at maximum capacity. The control of the return of classifier sand to the grinding mill also has received much attention. The engineers of the Utah Copper Company were assisted by the General Electric Company in devising the proper electrical equipment for the work. A roller device on the return end of the classifier continuously measures the thickness of the ribbon of oversize sand being returned to the ball mill. When the ore is hard, the circulating load in the classifier increases, and the increased thickness of sand raises the roller which automatically increases the speed of the rakes through control of the variable speed a. c. motor drive. When the ore is soft, the circulating load decreases and causes the regulator to decrease the speed of the rakes in order to avoid excessive turbulence in the settling pool of the classifier.

Another method for the control of the grinding circuit has been developed recently at the Castle Dome Copper Company and it also is based upon the load on the classifier. The staff at Castle Dome Copper Company has worked with the staff of the Westinghouse Electrical Corporation in developing the control. The sand load on the classifier is used as an index of the load on the ball-mill circuit. If, owing to varying friability of the ore feed, the grinding mill is getting too much feed, the sands in the classifier return build up; the resulting increased load on the classifier motor controls a regulator which automatically decreases the rate of feed of ore and water to the mill so that both the optimum capacity and the optimum pulp density are more closely maintained within the grinding mill and the classifier.

These automatically controlled grinding circuits produce a fluctuating tonnage dependent upon the variable grindability of the ore feed. When employed in circuits in which the classifier overflow goes direct to flotation, this fluctuation in tonnage may require further automatic control of rate of reagent feeding to maintain fully the gains in grinding if the flotation circuit is sensitive to reagent concentrations.

The Knoop Tester Measures Hardness of Small Sizes

A development which may lead to advances in the more fundamental aspects of the study of grinding is the availability of a standardized method and apparatus for the measurement of hardness of minerals. The Knoop hardness tester, originally developed and used by the Bureau of Standards, permits rapid quantitative measurement of the hardness of minerals in sizes as small as 150-mesh with results reproducible within 2 to 5 per cent. Now that this tester is available, many problems, such as the relationship between grindability of ores and hardness of mineral constituents, the effect of hardness of mineral constituents on build-up of minerals in closed-circuit grinding, and the general subject of attrition grinding in which hardness is probably the principal factor, may be reopened for further investigation.

Improved Separation in Flotation Induced by Heating

When various sulfide minerals are heated in the range of 250 degrees to 500 degrees C., the surfaces of some of the particles may be altered to a depth in the range of light interference effects, about ½ micron, and less. By experimentation, conditions of temperature and time may be found under which one sulfide mineral, such as pyrite, remains unaltered, and another, such as chalco-

pyrite, undergoes superficial oxidation to the extent that it can be depressed when the mixture is pulped and floated.

Superficial oxidation is being employed as part of the flow sheet at the Utah Copper concentrator. Here, a mixture of chalcopyrite and molybdenite, which has been depressed from the copper concentrate, is heated to about 275 degrees C. in a hearth roaster and then repulped, and the molybdenite is floated from the chalcopyrite, which is rendered nonfloatable by the heating process. This circuit has been operated successfully for more than five years. The ratio of MoS_2 to copper in the final concentrate is more than 2,600 times the ratio in the original ore.

A current problem of considerable immediate importance is the concentration of a chalcopyrite-cobaltite ore assaying about 0.9 per cent cobalt occurring in a large deposit containing up to 40 per cent of pyrite and pyrrhotite. The chalcopyrite was found to be readily floated from the iron sulfides and cobaltite, but extensive tests in the laboratory of the Bureau of Mines at Salt Lake City and other ore-testing laboratories failed to disclose a reagent combination that would effectively separate the cobaltite from the pyrite and pyrrhotite. The problem is being solved by floating a finished copper concentrate and a bulk sulfide concentrate in the rougher circuit. A superficial oxide film is then formed on the iron sulfides in the bulk iron sulfide-cobaltite concentrate by heating to 300 degrees C. thereby making it possible to depress the iron sulfides and float the cobaltite.

Conceivably the use of induced superficial oxidation in flotation processes may ultimately make possible such difficult separations as galena from silver-bearing tetrahedrite, nickel sulfides from copper and iron sulfides, sphalerite from partially oxidized copper sulfides, lead sulfide from copper sulfides, and even gold-bearing iron sulfides from barren iron sulfides.

Dry Concentration by Preferential Attrition Grinding and Air Classification

An interesting development in milling is the Mardun dry-disintegration, attrition-grinding and air-classification process for beneficiating the chrysocolla-cemented sandstones of arid northeastern Arizona. Minus ¾-in. dry ore is fed to the disintegrator, which consists of an 18-in. diameter cylindrical shell in which three 6-in. by 14-in. paddles revolve at 1,800 r.p.m. The disintegrator breaks down the sandstone ore to individual sand grains and scuffs the softer cementing minerals, chrysocolla and malachite, from the clean quartz grains. The disintegrated ore is passed through a de-duster unit consisting of a slanting system of louvers, and the coarse sand particles fall into a hopper, whereas the fine copper concentrate is air-swept to the baghouse collector.

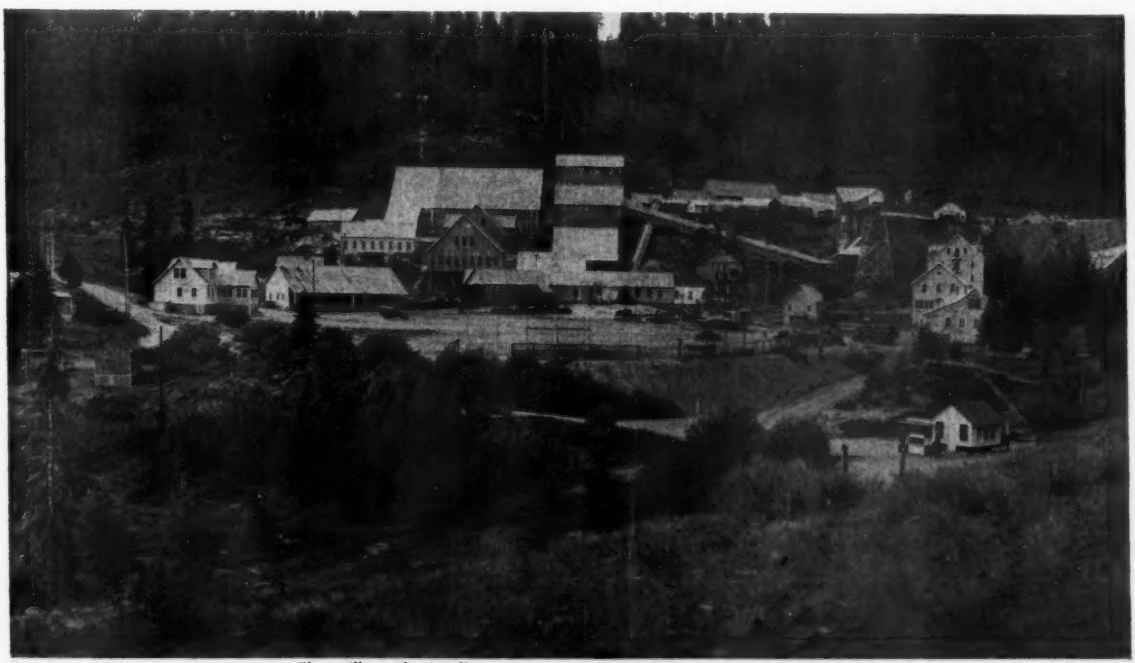
The process probably is applicable generally to loosely consolidated sandstones containing softer cementing materials. Among possible applications are the production of silica glass sand and foundry sand and the concentration of uranium and vanadium from the low-grade carnotite-bearing sandstone deposits of Colorado, Utah, Arizona and New Mexico.

The integral units of the process are inexpensive, simple to construct, small in size, easy to operate, and have a high capacity. Wear on the paddles is not great because most of the attrition is accomplished by wear of ore on ore.

Some New Uses of SO_2 for Metallurgical Purposes

An interesting development in the field of new uses for waste smelter gases is the dithionate process, which uses dilute SO_2 gas for leaching, but surprisingly permits the recovery of metal hydroxides by a simple precipitation with lime without the co-precipitation of $CaSO_4$.

This process was developed for treating low-grade manganese ores. A suspension of the ore in calcium dithionate solution is leached with dilute SO_2 gas, slaked lime is added to the resulting solution to precipitate the manganese as the hydroxide, and



The mill at the Walker Mine, one of California's copper producers

the precipitate is nodulized to form a high-grade manganese oxide product containing more than 60 per cent manganese and meeting specifications for high-grade manganese ore. In semi-pilot-plant tests carried out by the Bureau of Mines at a copper smelter, satisfactory leaching was obtained with waste smelter gas containing as little as 3 per cent SO_2. Most of the SO_2 is converted in the leaching step into calcium sulfate, which is rejected with the leach residue.

Preliminary tests made recently indicate that the dithionate process is also applicable to zinc ores and concentrates. This process shows particular promise for complex zinc ores from which suitable concentrates cannot be made by ore-dressing methods. For example, an off-grade sulfide concentrate, assaying 39 per cent Zn, and 13.3 per cent Fe, was roasted, and the calcine was treated by a modification of the dithionate process. Approximately 85 per cent of the zinc was recovered as a product that assayed more than 65 per cent zinc after being calcined. The leach residue contained all the lead, gold and silver, and assayed more than twice as high in these metals as the original concentrate.

A plant to employ the dithionate process economically should be near a very cheap source of SO_2 such as a smelter since the process fixes roughly 1.5 to 4 lbs. of SO_2 for each pound of zinc or manganese leached.

Ion-Exchange Resins for the Recovery of Metals from Solutions

In 1935, Adams and Holmes announced that resins of the phenol-formaldehyde type exhibit ion-exchange properties similar to the zeolites. Since then, a large variety of synthetic resins have been produced having exceptionally high cation-exchange or anion-exchange properties. In addition to their ability to remove positive or negative ions efficiently from solutions, they have good mechanical strength, can be used in relatively coarse sizes, such as 20- to 40-mesh, and can be regenerated by treatment with salt solutions, acids or alkalies as the case may require.

An important war-time application of ion-exchange resins was their use for the production of drinking water from sea water. Small ion-exchange units for removing dissolved salts from ordinary water are now available commercially; the resulting demineralized water can be used in place of distilled water for many purposes.

Since the ion-exchange resins remove ions such as calcium almost completely from water, it was natural that they should be tried for the recovery of the heavy and precious metals. Beaton and Furnas published results in 1941 giving data on the precipitation of copper sulfate indicating that copper from dilute solution could be concentrated 800 fold. In 1945, Sussman, Nachod and Wood showed that chromium, gold, platinum, palladium, iron, vanadian and molybdenum, when present in solution as anions (chromate, chloroaurate, chloroplatinate, etc.), can be removed by anion-exchange resins. Very little information is available, however, on the effect of resins when two or more metals are present in the same solution.

The very strong tendency of anion-exchange resins to remove complex anions of metals from solution suggests their use for the recovery of gold from cyanide solutions. If applicable, they would not merely be used as a substitute for zinc as a precipitant of gold but would present an answer to such problems as the cyanidation of low-grade ores containing clay, bentonite or other slime-forming constituents. For example, if gold could be precipitated completely on a resin after the gold had been dissolved by cyanide in a thick pulp, then by a simple process, such as screening, the gold-bearing resin could be separated from the pulp, thereby doing away with the expensive process of thickening and washing an aqueous suspension of slimes.

The data published to date on ion-exchange resins indicate a field of possible application not only to the recovery of gold from cyanide solutions but also to the recovery of other metals from dilute solutions such as mine waters, reject solutions from electrolytic processes, etc. These resins are now being used commercially in sugar refining and in various pharmaceutical, food and chemical industries. Several companies and the Bureau of Mines are now investigating the applications of ion-exchange resins to hydro-metallurgical processes.

Coal Preparation

Investigation Continued on Cleaning of Fine Coal Sizes. Progress Made in Anthracite and Bituminous Methods

By A. C. RICHARDSON
Supervisor, Coal Preparation
Battelle Memorial Institute

COAL preparation during 1946 has followed the general trends characteristic of the past few years. Greater and greater tonnages are being prepared mechanically with ever-increasing activity in new plant construction.

Anthracite

The increase in stripping and mechanized mining in the anthracite fields has enlarged the problem of producing acceptable grades of coal for the market. In this, as in other recent years, the major emphasis has been placed on the cleaning of the fine coal. Not only is more attention being given to the recovery and marketing of the finer sizes currently produced, but the recovery of fine anthracite from culm piles is being expanded.

The new equipment installed and contracted for during the year for cleaning the stove, egg and nut sizes of anthracite has been chiefly Wilmot jigs and Chance cones. For treating the fine sizes, the new equipment has been principally wet-tables and Wilmot Hydrotators and Hydroclassifiers.

Froth flotation is being used to recover fine anthracite on a small scale and one can anticipate developments in the process that will increase its application. One company is installing a Humphrey spiral separator to clean the smaller sizes.

Improved high-speed shaking and vibrating screens are being installed for dewatering the fine coal, and at one of the flotation plants it is planned to dry the cleaned coal in a flash-dryer.

The laws pertaining to stream pollution have made it increasingly necessary for many preparation plants to treat their effluent water to reduce the acidity and aid in precipitating the solids. Additional capacities for settling and impounding breaker water also are being provided.

During the year two new briquetting plants, each with a daily capacity of 1,000 tons of briquettes, were placed in operation. The briquettes are made on roll presses from a mixture of anthracite fines, bituminous fines and asphalt.

Bituminous

In the bituminous coal fields the trends in mining methods have had a marked effect on practically all phases of coal preparation. Mechanized and total-seam mining have not only greatly increased the quantity of refuse to be handled but the top size of the material delivered to the preparation plants is now so great that extra large, heavy screens and crushers are required for primary treatment. As a rule, the proportion of fines and their refuse content also is increased. The intensive stripping operations have added larger quantities of shale and clay to be removed and rendered more difficult the water clarification problem. In this manner progressively greater burdens are being placed on preparation plants that were not designed to handle such difficult cleaning problems. During the war years it was difficult to obtain repairs and replacements and comparatively few new plants were constructed. These factors, combined with more exacting market requirements, have created a demand for enlarged and improved coal preparation facilities that will require considerable time to satisfy.

The new equipment for cleaning bituminous coal contracted for during 1946 will have a capacity of about 12,000 tons of feed per hour and is probably a record. Of this capacity, it is estimated that about 10,000 tons will be in new tipples.

McNally-Pittsburg, Jeffrey, and Link-Belt Baum type jigs account for the greater part of the new cleaning capacity, but all types of cleaning equipment and processes are represented. These include Chance cones, Rheolaveur, Hydroseparators, Hydrotators, heavy medium, calcium chloride, wet tables and dry-cleaning units.

The year 1946 witnessed the introduction of no strictly new method of coal cleaning. There has been, however, further development of the innovations of preceding years and a general improvement in the design and construction of standard equipment.

The Heavy Media Process Appears Useful for Fine Sizes

The heavy medium process, developed for the concentration of ores, has been adapted to coal cleaning by the American Cyanamid Company, and at least one large installation is under way. The Link-Belt Company has developed a heavy medium apparatus that differs radically from that used in ore concentration. An experimental unit has been under test at a preparation plant during the past year and shows considerable promise. A preparation plant in the West has successfully used a Humphrey spiral separator to recover the coal from table middlings.

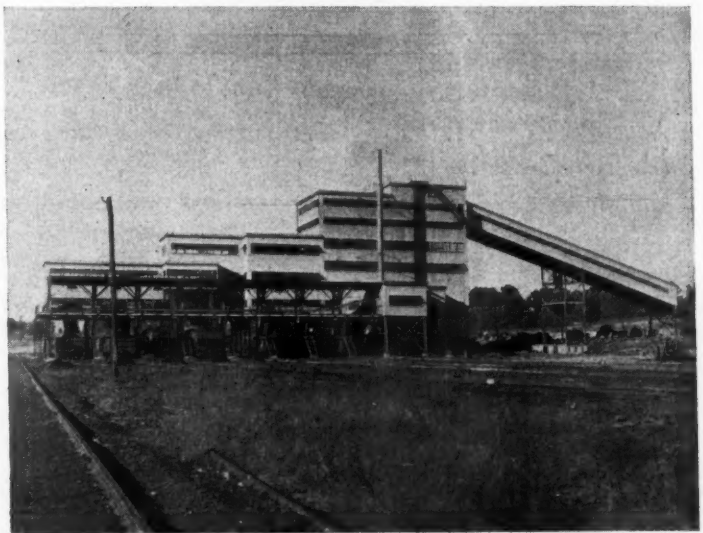
Engineers of the Dutch States Mines have developed a heavy medium process which will effectively treat coal as fine as 48 mesh. The separation is accomplished with a suspension of very fine sand in a cyclone tank. The raw coal and suspension enter the separator with high velocities and the centrifugal force developed aids in maintaining the required density of the medium and improves the specific gravity separation. In the Netherlands a commercial plant is in operation, and in this country the process has been investigated on a laboratory scale at the Northwest Experiment Station, U. S. Bureau of Mines. The results are encouraging and the process appears to offer one method by which heavy medium separations can be applied to the finer sizes of coal.

Increasing Interest in Mechanical and Heat Drying

The C. M. I. and Carpenter screen-type centrifugal dryers generally used to dewater fine coal have been improved in design and construction. Extensive interest is shown in the possibilities of using the Bird solid-bowl centrifuge to dewater fine coal and several have been installed in cleaning plants. The units have not been in operation for a sufficient length of time to fully evaluate their performance.

Coal producers are showing an increasing interest in the heat drying of coal, and there has been an improvement in the design and construction of the screen-type dryers which are most effective on sizes coarser than ⅛ in. It is generally believed that there is a pressing need for improved methods of drying coal that is finer than ¼ in. The recently developed Multi-Louvre Dryer has been on trial at two preparation plants during the past year, and is reported to give satisfactory operation. Raymond Flash Dryers are being installed at several plants for drying minus ¼-in. coal, and their performance at these initial installations will be observed with interest by the industry.

Gob fires and stream pollution are by-products of coal preparation that require better methods of control. The first is being lessened by improving the recovery of coal and decreasing the amount of combustible lost with the refuse. Another method is to crush all rock and refuse to a comparatively fine size before sending it to the dump. The fine refuse will pack more densely than the coarse material, and will have less tendency to fire. Stream pollution is being combated with chemical treatment of and greater settling capacities for the effluent from the washeries. Gob pile drainage is also receiving attention.



General surface plant recently completed by Roberts & Schaefer Co. at the East Diamond Mine of the West Kentucky Coal Co.

Past Year Registers Large Increases in Sales of Coal Mine Equipment*

W. H. YOUNG
and
R. L. ANDERSON
Chief and Assistant Chief
Bituminous Coal Section
Bureau of Mines

SHIPMENTS of mechanical loading equipment for underground use in coal mines in the United States, in terms of capacity, were 20 per cent greater in 1946 than in 1945 and were almost as large as in the record year 1941.

The capacity of mechanical cleaning equipment sold for use at bituminous-coal mines in 1946 was 78 per cent greater than in 1945.

Shipments of "mother" conveyors increased 32 per cent in 1946 over the previous year, and shuttle car sales in 1946 more than doubled the number sold in 1945.

This survey was made possible by the courteous cooperation of all known manufacturers of mechanical cleaning equipment for bituminous coal and manufacturers of mechanical loading and supplementary haulage equipment for use in all coal mines; data from various trade journals were also utilized.

Mechanical loading units "sold in 1946" represent shipments made during 1946. Only a small percentage of the mechanical cleaning equipment sold in 1946 was placed in operation during the year; the balance will be installed during 1947 and 1948.

Mechanical Loading

Although the tonnage of coal mechanically loaded at underground bituminous-coal and lignite mines decreased from 274,189,132 tons in 1944 to 262,512,729 in 1945, the percentage of the total underground output so loaded increased from 52.9 in 1944 to 56.1 in 1945. Mechanical loading in Pennsylvania anthracite mines showed similar trends; tonnage decreased from 14,975,146 in 1944 to 13,927,955 in 1945, while the percentage of the total underground output mechanically loaded increased from 35.8 to 39.9 during the same period.

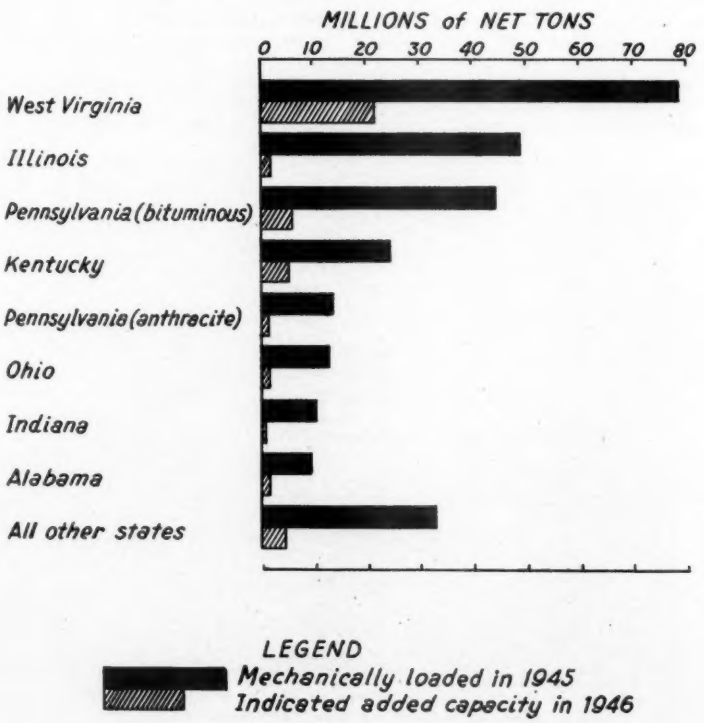
Table 1 shows data on bituminous coal and lignite by methods of mining and mechanical cleaning for the years 1944-46, inclusive. Preliminary estimates for 1946 indicate that for every ton loaded by hand 2 tons were loaded mechanically by power shovels at strip mines or by loading devices in deep mines.

Types of Units Sold—Table 2 shows the number of units of mechanical loading equipment sold to bituminous-coal, anthracite and lignite mines for underground use in the United States for the years 1939-46, inclusive.

Mobile loader sales in 1946 totaled 495, exceeding the previous high record of 1941, when 368 units were sold. Sales of scrapers increased from 26 in 1945 to 35 in 1946, an increase of 34.6 per cent. Conveyor sales were 1,157 in 1946, compared to 861 in 1945, an increase of 34.4 per cent.

Regional Distribution of Sales—Table 3 shows the number of mechanical loading units shipped during 1946 to the various States and regions. Types of equipment shipped are indicated by letter symbol in approximate order of capacity. For example, 70 mechanical loading units were shipped to Alabama. Of this total number of units shipped, mobile loading machines (indicated by "L") furnished the largest addition to capacity, followed by conveyors ("C") and scrapers ("S"). Capacities are based on 1945 records of actual performance as reported by mine operators. In 1946, 1,331 mechanical loading units of all types were shipped to bituminous-coal and lignite mines, compared with 1,093 in 1945, an increase of 238 units or 22 per cent. The total number of units shipped to Pennsylvania anthracite mines increased from 153 in 1945 to 356 in 1946, or 133 per cent.

Mechanical loading equipment exported in 1946, in terms of capacity,



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amounted to approximately 11 per cent of the shipments made to mines in the United States.

Types of Loading Equipment Sold Compared With Units in Use—The trend in demand for various types of mechanical loading equipment is shown in table 4. The number of mobile loaders and hand-loaded conveyors in use at bituminous-coal and lignite mines more than doubled in the seven-year period 1938-45. Conveyors equipped with duckbills or other self-loading heads showed the largest gain, increasing from 346 in 1938 to 1,383 in 1945, or 300 per cent. The number of scraper loaders in use dropped from 117 in 1938 to 87 in 1945, and pit-car loaders in use decreased from 1,392 to 142 during this 7-year period. Pit-car-loader sales totaled 139 in 1938. During the 6 years 1939-44, inclusive, only 18 sales were reported; the canvass of pit-car-loader sales was therefore discontinued in 1945. Conveyors in use, hand-loaded and self-loading combined increased from 1,872 units in 1938 to 4,768 in 1945, or 155 per cent.

The total number of mechanical loading units of all types in use at Pennsylvania anthracite mines increased from 2,376 in 1938 to 3,574 in 1945, or 50 per cent, compared with an increase of 66 per cent at bituminous-coal and lignite mines for all types during the same period.

Types of Equipment Purchased by Regions—Table 5 shows the number of mobile loaders, scrapers and conveyor units shipped into various States and regions during 1946 and the number of units in use in 1945. West Virginia continued to receive the greatest number of mobile loaders, Pennsylvania, Kentucky and Alabama following in the order named. Pennsylvania anthracite mines received only five of the 495 mobile loaders shipped in 1946.

Pennsylvania anthracite mines received 32 of the 35 scrapers sold during 1946.

Conveyor units sold to Pennsylvania anthracite mines increased from 14 per cent of the total conveyor sales in 1945 to 28 per cent in 1946.

Supplementary Haulage Equipment

"Mother" Conveyors—For the purpose of this survey a "mother" or haulage conveyor is defined as a sectional, extensible, power-driven conveying unit that can handle over 500 ft. of conveyor. (Main-slope conveyors are excluded.)

Sales of "mother" conveyors were included in the survey for the first time in 1945, when 142 sales were reported. Sales in 1946 increased to 187, as shown in table 5. West Virginia received the largest number of "mother" conveyor units shipped in 1946, followed by Wyoming, Pennsylvania, Kentucky and Illinois in the order named.

No estimates of the capacities of these "mother" conveyors have been made and they are not included in any of the summaries of mechanical loading equipment.

Trackless-gathering Equipment—Sales of shuttle cars or rubber-tired, self-powered haulage units in 1946 were more than twice those in 1945. Deliveries were made in 14 States in 1946; West Virginia received the greatest number, and Kentucky, Pennsylvania, Illinois and Alabama followed in the order named. During 1945, 23 per cent of the total bituminous coal loaded by mobile loaders was handled by shuttle cars, and 4 per cent was loaded onto conveyors as the first step in its transportation. The remainder of the mobile loader tonnage (73 per cent) was loaded directly into mine cars.

TABLE 1—BITUMINOUS COAL AND LIGNITE PRODUCTION BY METHODS OF MINING AND MECHANICAL CLEANING, IN THE UNITED STATES, 1944-46, INCLUSIVE

	1944		1945		1946 [1]	
	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total
Surface stripping	100,898	16.3	109,987	19.0	109,000	20.5
Hand loaded underground	244,489	39.5	205,118	35.5	177,000	33.3
Mechanically loaded underground	274,189	44.2	262,512	45.5	246,000	46.2
Total production	619,576	100.0	577,617	100.0	532,000	100.0
Mechanically cleaned	158,727	25.6	147,886	25.6	140,000	26.3

[1] Preliminary.

TABLE 2—UNITS OF MECHANICAL LOADING EQUIPMENT SOLD TO BITUMINOUS COAL, ANTHRACITE, AND LIGNITE MINES FOR UNDERGROUND USE IN THE UNITED STATES, AS REPORTED BY MANUFACTURERS, 1939-46, INCLUSIVE

Type of equipment	1939	1940	1941	1942	1943	1944	1945	1946	Percent change, 1946 from '45
Mobile loaders	292	233	368	352	234	286	359	495	+ 37.9
Scrapers [1]	26	39	11	29	15	39	26	35	+ 34.6
Conveyors [2]	1,311	1,762	2,130	1,491	1,100	708	861	1,157	+ 34.4
Pit-car loaders [3]	2	3	10	2	1	....	(3)	(3)	....
Total, all types	1,631	2,037	2,519	1,874	1,350	1,033	1,246	1,687	+ 35.4
No. manufacturers reporting	31	32	32	28	24	22	25	23	....

[1] Reported as scrapers or scraper haulers and hoists.
[2] Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads. Sales of both loading heads and shaker conveyors were counted for the years 1939-41, inclusive, but the figures for 1942-46, inclusive, do not include loading heads separately.
[3] Canvass of sales of pit-car loaders discontinued in 1945.

TABLE 3—TOTAL NUMBER OF UNITS OF MECHANIZED LOADING EQUIPMENT SHIPPED FOR USE IN EACH STATE OR REGION IN 1946

(L, mobile loading machines; S, scrapers; C, conveyors)

State and region	Number of units of all types shipped in 1946	Types of equipment in approximate order of capacity
Northern Appalachian States:		
Maryland	5	C.
Michigan	3	C.
Ohio	57	L. C.
Pennsylvania	213	L. C.
Southern Appalachian States:		
Alabama	70	L. C. S.
Kentucky	156	L. C.
Tennessee	25	L. C.
Virginia	35	L. C.
West Virginia	594	L. C. S.
Middle Western States:		
Illinois	32	L. C.
Indiana	19	L. C.
Trans-Mississippi States:		
Arkansas	12	C.
Colorado	32	C. L.
Iowa and Kansas	8	L. C.
New Mexico and North Dakota	11	L.
Oklahoma	13	C.
Utah	17	L. C. S.
Wyoming	29	C. L.
Total bituminous and lignite	1,331	L. C. S.
Pennsylvania anthracite	356	C. S. L.
Grand total	1,687	L. C. S.

Table 6 shows the number of mobile loaders in use in bituminous-coal and lignite mines by States and regions and types of loading in 1945. Of a total of 2,950, 579 mobile loaders loaded into rubber-tired trucks or shuttle cars. A mobile loader that employs shuttle cars requires one to three cars. Therefore, approximately 1,100 shuttle cars were used in bituminous-coal mines in 1945.

Mechanical Cleaning

Sales of Mechanical Cleaning Equipment for Bituminous Coal—Reports on sales of bituminous-coal-cleaning equipment from 15 manufacturers show that installations were made in 9 States in 1946, as compared with 11 States in 1945; however, the total capacity of 1946 installations was 78 per cent greater than that of 1945.

The total capacity of bituminous-coal-cleaning equipment sold in 1946 was 18,000 net tons of cleaned coal per hour, as compared with 10,100 net tons capacity sold in 1945.

The report on one large sale made in 1945 was received too late to be included in sales for that year; however, it was included in 1946 sales. Most of the equipment sold in 1946 will be placed in operation in 1947. A few of these plants were installed in 1946, but several will not be completed until early in 1948. In terms of capacity, about one-third of the installations were made at mines as additions to or replacements of equipment at mines that already had cleaning plants, and the other two-thirds were made at mines that had no cleaning facilities. West Virginia ranked first in terms of capacity of sales made in 1946, followed by Pennsylvania, Illinois, Ohio and Indiana in the order named.

Wet methods of coal cleaning employ piston- or common-type jigs, Baum-type jigs, concentrating tables, launders and upward-current classifiers, or any combination of these four methods. During 1945 about 87 per cent of the total bituminous coal cleaned was cleaned by wet methods. Baum-type jigs cleaned approximately 42 per cent of the total coal cleaned by wet methods during 1945. More than 90 per cent of the capacity of the 1946 sales of cleaning equipment was for plants that clean by "wet" methods.

Pneumatic methods of coal cleaning employ air tables, air flow, air sand, or any combinations of these three methods. During 1945 air tables cleaned approximately 59 per cent of the total coal cleaned by pneumatic methods. About 13 per cent of the total bituminous coal cleaned in 1945 was cleaned by pneumatic methods. Less than 10 per cent of the capacity of the 1946 sales of cleaning equipment was for plants that clean by "pneumatic" methods.

TABLE 4—SALES OF MECHANICAL LOADING EQUIPMENT IN 1946 COMPARED WITH TOTAL NUMBER OF MACHINES IN ACTIVE USE IN PRECEDING YEARS

	Number of machines in active use, as reported by mine operators								No. machines sold as rep't'd by manufact'rs in 1946
	1938	1939	1940	1941	1942	1943	1944	1945	
Bituminous and lignite mines:									
Mobile loading machines	1,405	1,573	1,720	1,985	2,301	2,525	2,737	2,950	490
Scrapers	117	131	116	109	93	83	87	87	3
Pit-car loaders	1,392	873	697	607	481	321	241	142	(1)
Conveyors equipped with duckbills or other self-loading heads	346	559	656	788	1,062	1,226	1,331	1,383	(2)
Hand-loaded conveyors, number of units	1,526	1,834	2,263	2,807	3,041	3,191	3,236	3,38[illegible]	838
Anthracite mines (Pa.):									
Mobile loading machines	(3)	(3)	(4)	[illegible]	(4)	(4)	(4)	(4)	5
Scrapers	545	535	[4] 547	[4] 505	[4] 524	[4] 515	[4] 503	[4] 568	32
Pit-car loaders	(3)	(3)	(5)	(5)	(5)	(5)	(5)	(5)	(1)
Conveyors equipped with duckbills or other self-loading heads	(3)	(3)	(5)	(5)	(5)	(5)	(5)	(5)	(2)
Hand-loaded conveyors, number of units	[3] 1,831	[3] 1,997	[5] 2,189	[5] 2,432	[5] 2,491	[5] 2,701	[5] 2,807	[5] 3,006	[2] 319

[1] Canvass of sales of pit-car loaders discontinued in 1945.
[2] Sales of conveyors equipped with duckbills or other self-loading heads are included with hand-loaded conveyors.
[3] Mobile loading machines, pit-car loaders, and conveyors equipped with duckbills or other self-loading heads are included with hand-loaded conveyors.
[4] Mobile loading machines are included with scrapers.
[5] Pit-car loaders and conveyors equipped with duckbills or other self-loading heads are included with hand-loaded conveyors.

TABLE 5—COMPARISON OF MECHANICAL-LOADING EQUIPMENT AND "MOTHER" CONVEYORS IN ACTUAL USE IN 1945 WITH SALES REPORTED IN 1946, BY STATES AND REGIONS

State and region	Mechanical loading equipment						"Mother" conveyors [2]	
	Mobile loaders		Scrapers		Conveyors [1]			
Bituminous and lignite mines	In use in 1945	Sales in 1946	In use in 1945	Sales in 1946	In use in 1945	Sales in 1946	In use in 1945	Sales in 1946
Northern Appalachian States:								
Maryland	....	...	....	...	31	5	....	...
Michigan	....	...	....	...	5	3	1	2
Ohio	174	22	....	...	155	35	23	10
Pennsylvania	651	90	13	...	822	123	92	29
Southern Appalachian States:								
Alabama	103	26	49	1	396	43	63	7
Kentucky	237	55	1	...	594	101	107	20
Tennessee	11	5	....	..	168	20	32	2
Virginia	78	11	....	...	127	24	8	10
West Virginia	764	216	2	1	1,395	377	270	51
Middle Western States:								
Illinois	570	23	....	...	26	9	27	14
Indiana	160	13	....	...	....	6	2	1
Trans-Mississippi States [3]	202	29	22	1	1,049	92	84	37
Total bituminous and lignite	2,950	490	87	3	4,768	838	709	183
Anthracite mines:								
Pennsylvania	(4)	5	[4] 568	32	[5] 3,006	319	(6)	4
Grand total	(6)	495	(6)	35	(6)	1,157	(6)	187

[1] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[2] Includes all haulage conveyors with capacity over 500 ft. except main-slope conveyors.
[3] Includes Arkansas, Colorado, Iowa, Kansas, Montana, New Mexico, North Dakota, Oklahoma, Oregon, Utah, Washington, and Wyoming.
[4] Mobile loaders included with scrapers.
[5] Includes pit-car loaders and duckbills or other self-loading conveyors.
[6] Data not available.

TABLE 6—NUMBER OF MOBILE LOADERS IN USE IN BITUMINOUS COAL AND LIGNITE MINES, BY STATES AND REGIONS, SUBDIVIDED BY TYPES OF LOADING IN 1945

State and region	Number of mobile loaders			
	Loading direct into mine cars	Loading onto conveyors	Loading into rubber-tired trucks	Total number in use
Northern Appalachian States:				
Ohio	115	31	28	174
Pennsylvania	481	40	130	651
Southern Appalachian States:				
Alabama	27	51	25	103
Kentucky	148	9	85	237
Tennessee	2	...	9	11
Virginia	71	2	5	78
West Virginia	625	17	122	764
Middle Western States:				
Illinois	454	26	90	570
Indiana	117	...	43	160
Trans-Mississippi States [1]	141	19	42	202
Total	2,176	195	579	2,950

[1] Includes Colorado, Iowa, Montana, New Mexico, North Dakota, Oklahoma, Utah, Washington, and Wyoming.

Geophysical Prospecting For Ores

By LOUIS B. SLICHTER
Professor of Geophysics
University of Wisconsin

Our Industrial Prosperity is Directly Dependent on Mineral Resources. The Development of New Ore Finding Techniques is Recognized as a Fundamental Requirement for Successful, Modern Prospecting. The Discovery of New Orebodies May Hinge on the Application of Methods Such as These Described in Brief by Dr. Slichter

THE situation which confronts us with respect to sources of important metals has been emphasized during the last year by leading mining authorities.[1] Geophysical prospecting being one of the newer tools of geology, is often mentioned as offering a measure of hope for the improvement of prospecting efficiency. It is true that geophysics is being developed to higher technical effectiveness, and no doubt will be applied with increasing discernment and skill by exploration geologists. It must nevertheless be recognized that geophysical methods are inevitably restricted in scope, and are effective only under unusual geological conditions. Hence success in meeting the problems of re-establishing a favorable position in respect to metal reserves must be founded on a much broader approach than the geophysical one. One of the most basic needs is to re-establish a favorable economic climate for mining prospecting, to make the venture worth the candle. Recognition in taxation policy of ventures of special risk such as prospecting is needed. Tax policies should stimulate prospecting, not penalize it.[2] A second basic need is that emphasized by Dr. Wrather, namely the need for a far greater research effort concerning all aspects of exploration. In a country where continued prosperity is so dependent upon mining resources, it is especially desirable that every necessary aid and facility be given to the cause of exploration, and to the promotion through research of more efficient prospecting and mining. Geophysical methods are scientific tools of special, and therefore limited, usefulness—but their development is perhaps of broad significance to the mining industry, as another illustration of the desire to bring to bear on mining exploration problems the power of scientific research.

Direct Participation by Mining Companies in Geophysical Work

Irrespective of future progress in geophysical technology, an important improvement in performance will automatically result as the exploration staffs of mining companies acquire more expert knowledge of the practical utilization of geophysics. One of the essential elements for the success of geophysics in the oil industry was the continuous effort, both in the field and in the laboratory, to understand the operation of the geophysical tools, and to arrive at the geophysical techniques, and of the posphysical data being obtained. The exploration staffs of the oil companies obtained through long experience and study, a thorough understanding of geophysical techniques, and of the possibilities of their use. With the more limited field of application of geophysics in mining, and the relatively lesser importance of prospecting in the mining business, the mining companies are, of course acquiring expert knowledge about geophysics much more slowly. Mining companies have usually utilized geophysics through short time contracts with outside consultants. The intermittent prospecting of smaller companies or syndicates of limited financial resources must, of course, be done under short time contracts, and for such requirements (as well as others) independent geological and geophysical consultants will continue to supply a most valuable and necessary service. But some of the larger mining companies which have permanent exploration departments are beginning to adopt a more continuous policy in respect to geophysics, as they have done long since with respect to geology. At least a nucleus of scientific staff should be provided within the company itself to keep abreast of the march of science as it affects exploration and to build up a "know how" with respect to new ideas and techniques. This enables the company to participate with understanding in work of outside consultants, if they be called in. Only when there is direct participation by the company's own staff can the results of technical experience be preserved to the com-

[1] For example, Dr. Reno Sales, Chief Geologist of Anaconda Copper Company, states in "Ore Reserves and Future Exploration," American Mining Congress, Denver, Colo., September 12, 1946: "My own opinion is that a serious situation confronts our nation with respect to copper, lead and zinc. If we do not find more ore bodies of copper, lead and zinc in the next forty years than were found in the last forty, the 'have nots' will have won the argument."

Also Dr. W. E. Wrather, Director of U. S. G. S. Address at annual meeting of the Colorado Mining Association, Denver, Colo., January 25, 1945: "Almost without exception, the deposits now being worked in our principal metal mining districts were known—at the beginning of the century, and for all their traditional importance and size, we have at last come to realize that they are exhaustible. . . . Tomorrow's high grade ore exists today in imagination only. It will be found only by the exercise of all the wit and ingenuity that can be conjured up by the combined scientific and practical talents of the industry."

[2] Ira B. Joralemon, Cons. Eng. "The Treatment of New Mining Ventures in Canada and the United States." American Mining Congress, September 12, 1946.

pany as working assets for continued use.

Progress in Geophysical Techniques

1. *The Airborne Magnetometer*

From the point of view of mining prospecting, probably the most significant development which resulted from wartime research is the airborne magnetometer developed under support of the Office of Scientific Research and Development from an initial program of the Gulf Oil Company. The airborne magnetometer furnishes a continuous graphical record of the magnetic intensity, with a sensitivity superior to the best previously available field instruments. It was used in considerable numbers for finding submarines from airplanes and blimps, and was capable of detection of submarines several hundred feet below the surface from planes several hundred feet above the sea. The flying magnetometer has been adapted to geological reconnaissance by the U.S.G.S., and furnishes a rapid means of surveying large inaccessible areas at low cost. It provides reliable magnetic maps, which should prove of great value in directing the course of more detailed exploration. For example, in the western states, the flying magnetometer should be of value in tracing the geology of the ranges out under the valley floors; and in drift-covered areas, such as parts of Canada, concealed magnetic features can be economically traced, with revelation in many instances of geological structures, such as faults, dikes, or contacts whose mapping would be prohibitively expensive by conventional methods. In aerial magnetic mapping, the accurate determination of the positions of the fast moving plane is a primary problem. In addition to the magnetic detector, which is relatively light in weight, electronic gear for position and altitude determinations is required, which brings the total weight of apparatus up to around 500 pounds. Two motored planes with a crew of three are usually employed. A slower, but more flexible method of aerial magnetic surveying involves the carrying of a magnetometer by a helicopter, as by Lundberg,

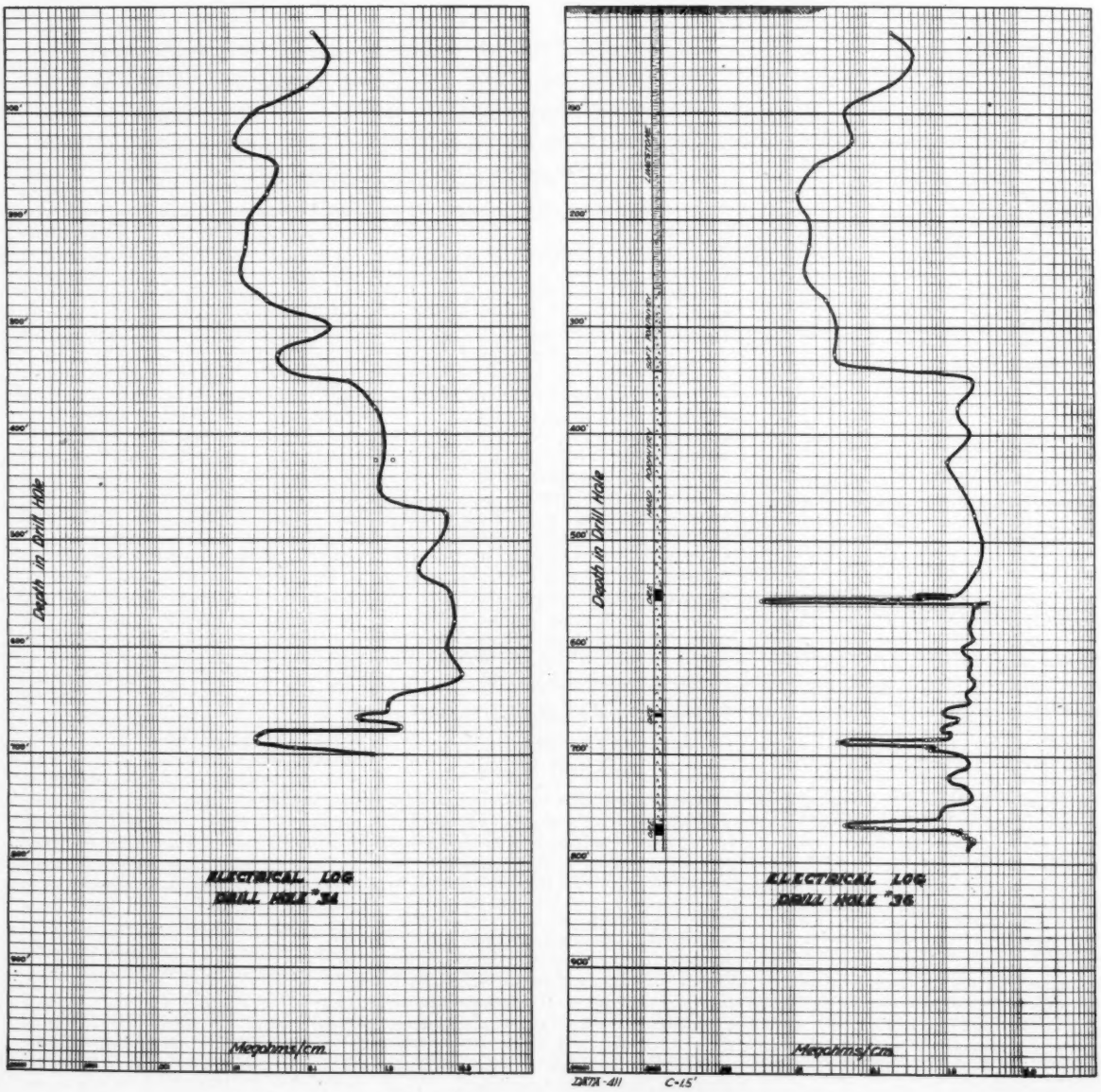


Figure 1—An "electrical log" of two adjacent holes at Iron Mountain, Missouri.

in Canada. The airborne magnetometer may be expected to contribute most valuably to the magnetic and geological mapping of large areas. Small detailed surveys in accessible areas will continue to be most satisfactorily and economically accomplished on the ground, by conventional magnetometers, or their successors. The airborne type of magnetometer (permalloy type) will probably find important use on land, as a simple and sensitive instrument for measuring all three components of the magnetic field.

2. *Gravimeters*

Another geophysical procedure which has received phenomenal improvement in speed, economy, and sensitivity, is gravity prospecting. Several decades ago, the torsion balance and the pendulum were the standard instruments for observations of gravitational quantities in the field. Both are very slow, requiring four hours or more per station occupied. New instruments called gravimeters have in recent years been widely used in petroleum prospecting. A good gravimeter can measure relative values of gravity with a sensitivity about a hundred fold greater than that of the pendulum and requires but a few minutes per reading instead of hours. It is at the same time very light and portable. These great improvements in speed, economy, and sensitivity have greatly multiplied the field of utility of gravity work in oil prospecting. In mining prospecting, only a very limited use of gravimeters has thus far been made. The instrumental performance has, however, been brought to a satisfactory state, and gravity surveys can be relatively quickly made if geological conditions indicate their desirability. The field of application for gravimeters in mining appears, however, to be only a small and special one.

Geophysical Use of Drill Holes

Electrical methods offer a powerful method of revealing conducting ore straddled by drill holes, and are otherwise useful in promoting the economy and effectiveness of a drilling campaign. A simple example in which D. C. electrical methods furnished useful results in drill holes is provided by fig. 1 and fig. 2. Fig. 1 represents a standard "electrical log" of two adjacent drill holes in specular hematite ore of the Iron Mountain, Mo. area. The curves show the electrical resistivity of the rock at successive depths in the holes. In the left hand hole note there is one ore horizon; in the right, three. In such cases the question arises, how are the several ore shoots connected if at all? The curve in fig. 2 furnishes a simple answer to this question—This curve represents the voltage measured at successive depths in the right hand hole (the drill holes were full of water) when D. C. current at 100 volts is introduced in the left hand hole at the depth of the ore showing. This curve has a sharp peak of about 2½ volts opposite the upper of the three shoots, but the other two ore zones produce no appreciable irregularities in the curve. It is clear that only the upper ore horizon in hole #36 is in good electrical contact with the ore in hole #34. This simple example shows how easy it may be to obtain by electrical surveys additional information from drill holes. Only the most elementary means, such as might be used in testing the continuity of a door bell circuit were involved. In the present instance, one of the ore shoots happened to have been pierced by both holes. If the ore had been missed by a distance of ten feet or so by one or even both of the holes, the chances are still good that it would have been picked up by the electrical survey. Drill holes provide the opportunity of adding the important third dimension to electrical maps, and the opportunity of supplying electrical current to the ground at the most favorable possible location, namely, either in the ore, or near to the hypothetical ore. Conducting ore bodies of fair size straddled by a pair of holes can often be relatively easily revealed by the methods indicated. Use of electrical methods in connection with drilling campaigns can reduce the cost of exploration for conducting ores, by enabling larger spacings between holes, and at the same time can increase the effectiveness of the survey by discovering any sizable ore bodies which may have been straddled.

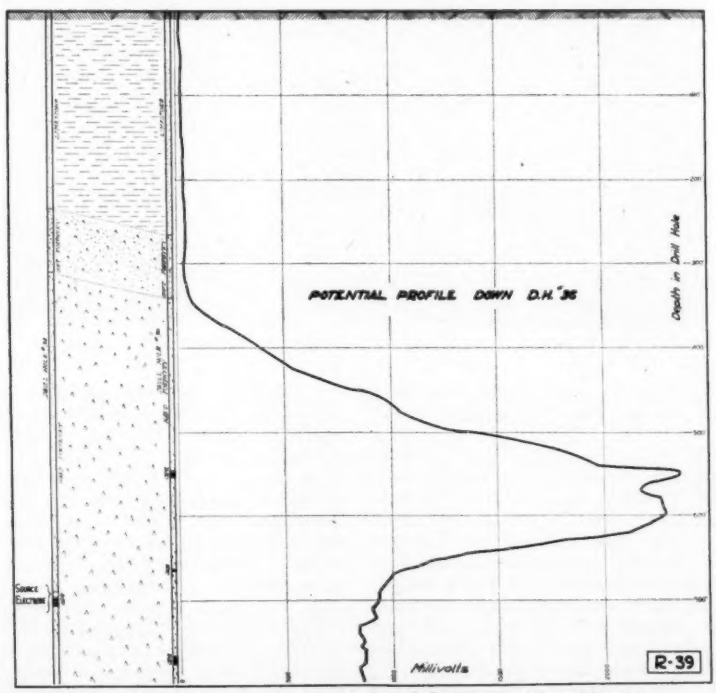


Figure 2—Voltage at successive depth in hole No. 36 at Iron Mountain.

Surface Potential Mapping of Ore Pierced by Drill Holes

When ore of only moderate electrical conductivity has been pierced by a drill hole, it is sometimes possible to predict the direction of the continuation of the ore, and the importance of the ore body as to size, by simple electrical measurements. Electrical contact is made at or just below the ore horizon, and direct current at 100 volts or more is passed between the ore and any convenient but distant point. Under these conditions, the pattern of electric current flow in the neighborhood of the ore is strongly controlled by the shape of the ore body. At the earth's surface, the pattern tends to reflect the shape of the ore, and is elongated in the direction of the ore's extension,—sometimes even though the intervening overburden may be five or six hundred feet thick. It is to be noted, of course, that the electrical distribution at the surface also necessarily receives distortion from other geological conductors. Thus variations

in the thickness of a water-saturated overburden may also produce significant distortion in the map. However, in the case of the process outlined, such uncertainties are fortunately very much less serious than in the case of conventional applications of the D.C. method in surface prospecting. In the first place, the magnitude and character of the influence of surface conductivity, can usually be revealed experimentally, by raising the power electrode previously in contact with ore to successive higher horizons, and noting the change in the electrical pattern at the surface. At the higher positions the effect due to ore will tend to disappear, while the influence of surface topography will be enhanced. Thus experimental corrections can be determined, the validity of the interpretations confirmed, and the accuracy improved. In the second place, the direct electrification of the ore by contact with the high voltage terminal of an electrical generator produces an unusually powerful means of revealing the ore. The entire ore body is raised to a high electrical voltage. The result is a large increase in depths to which ore bodies may be effectively studied. Successful results have been obtained at depths about equal to the length of the ore body, and under favorable circumstances possibly greater depths may be attained. In figures 3 and 4 are shown examples of the application of the technique just described. In figure 3 is shown a normal, relatively undistorted map of electrical potentials taken with the power electrode at about 200′ depth in a drill hole in barren quartz porphyry. The contour lines are lines of equal electrical potential. In figure 4 is seen a map of similar type in the same district with the electrode at about 250′ depth in specular hematite ore occurring in the quartz porphyry. The distortion of the contours by the ore body is amazingly great, so that the center of the small equipotential contour just west of the railroad track has been displaced about five hundred feet from its normal position above the electrode. (This electrode's position is shown just west of the rectangular caption-box). The large extent of the ore body to the west of the electrode is obvious.

More extensive use of electrical methods in connection with drilling and underground workings is urged.

Model and Computational Aids

The interpretation of D.C. prospecting results, such as those described in the preceding paragraph is greatly aided by the use of simple geometrical scale-models, which incorporate the major variations in the electrical conductivity of the full scale prototype.

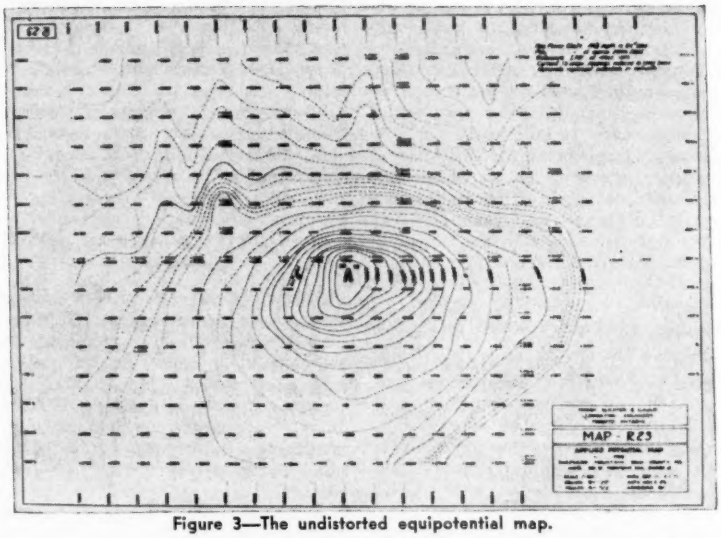


Figure 3—The undistorted equipotential map.

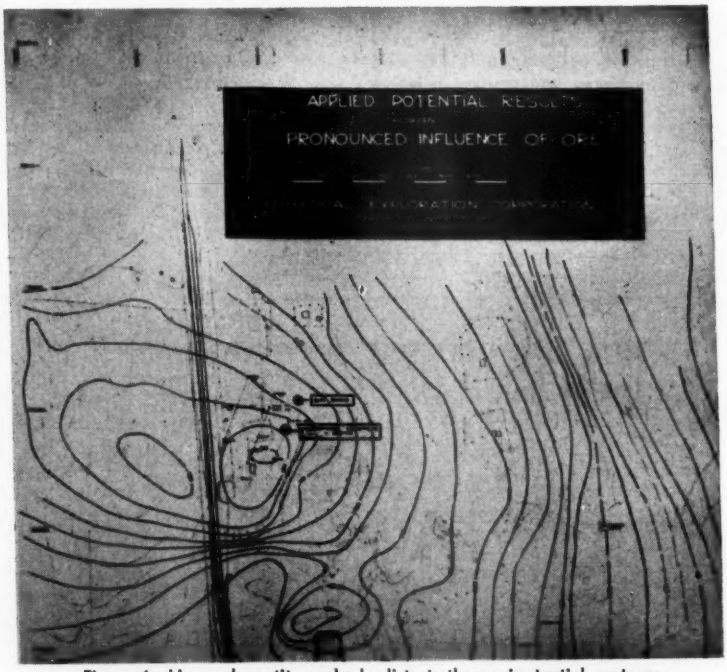


Figure 4—Here a hematite orebody distorts the equipotential contours

When the geometry of the ore body and its associated geological structures is of complicated form, as it usually is, mathematical methods offer only limited aid in interpreting field results. Under such circumstances the small scale model offers the only practical way of studying the electrical prospecting problem in a quantitative manner. Much insight into the fundamentals of electrical prospecting can easily be obtained through experimentation with simple models. The use of such models by the mining industry is apparently only beginning. They will prove as indispensable in difficult electrical studies as the corresponding three dimensional mine model has proven in geological studies.

In the case of the interpretation of inductive prospecting methods, model techniques would also be very useful. The problem of constructing a true inductive-model is slightly more difficult than the corresponding one for direct current, because the conductivity of the different portions of the inductive model is fixed, when the frequency and geometrical scale is determined; in the D.C. model, only the ratios of the conductivities need

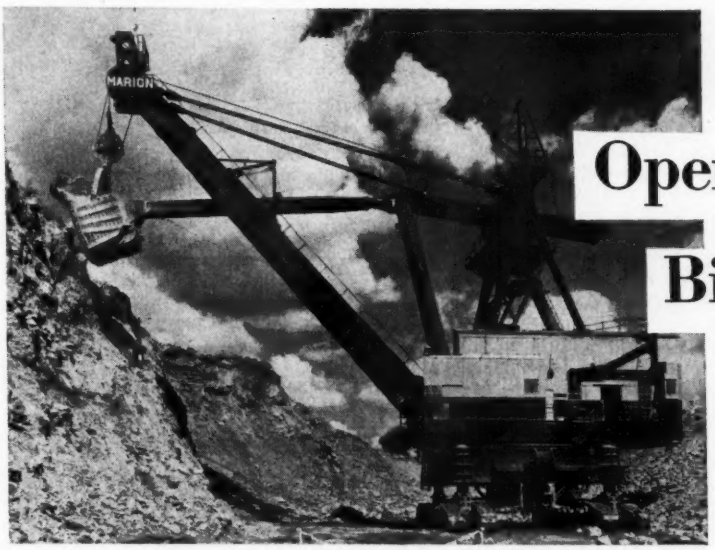
to be preserved equal in model and prototype. Absolute values are without significance. Heretofore, only highly idealized problems have been studied inductively with models. Much remains to be done concerning the practical design and operation of models of actual geological situations.

Large Computing Machines

The modern development of large scale digital computing machines, and of differential analyzers, promises much aid to the applied geophysicist in the analysis and interpretation of field data. It is to be hoped that such machines will be brought to the stage where boundary value problems of complicated geometrical type can be readily handled.

New Techniques Deserving of Investigation

Two additional lines of advance in the application of geophysics to ore prospecting seem to deserve further study. These are improved electrical prospecting methods operating on induction principles and at frequencies especially suited to the electrical resistivity of the local geological structures; and the study of seismic wave methods which have been outstandingly successful in petroleum prospecting, with the object of adapting these methods to the more difficult requirements of ore prospecting. Advances in such projects as these may distinctly improve the utility of geophysics in mining exploration. The great improvements recently achieved in both the magnetic and gravitational methods, and the possibilities still to be explored in the electrical and seismic methods, indicate that the field for geophysical research in ore prospecting is still a live one.



Open Pit Mining of Bituminous Coal

The Development of New Mining Areas and the Use of Larger Capacity Shovels and Draglines Keynote the Latest Chapter of Bituminous Stripping History

By WILLIAM L. BURT
President
Greenland Coal Corp.

AS 1946 came to a close, another important chapter was added to the stripping industry. Estimated production figures show a slight decline over 1945 but this may not be very significant in predicting the future of the industry.

One fact that is noticeable, however, is the definite trend toward use of new territory and this is clearly shown by the decrease in 1946 estimated production of Illinois and Indiana, both old timers in large producing stripping states. Illinois will show a drop of 3,000,000 tons while Indiana loses nearly 2,000,000 from its 1945 figure. In examining production figures of the various states to find where this loss in the national figure is made up, we find that Pennsylvania is the leader, having an increase of 2,700,000 tons. Pennsylvania was until a few years ago a small stripping state from the tonnage standpoint. It is today the largest producer in the country, going well over 29,000,000 tons for 1946.

Many of us thought that the numerous road and construction contractors, who made up a large portion of the national production figures during the war, would retire to their construction contracts at the end of hostilities. Because of the coal shortage, labor difficulties and consequent maintained demand, this is apparently not the case.

West Virginia will show an increase in production over 1945, as will Kentucky and North Dakota, while Ohio will drop over 1,000,000 tons.

Newer Operations Use Larger Excavation Equipment

The year 1946 found most machinery manufacturers reconverting their plants to peace-time operation and keeping drafting boards busy with new ideas. However, the war demand for coal brought on two distinct changes in the industry: namely, the employment of very much larger

ESTIMATED STRIP BITUMINOUS TONNAGES, BY STATES

	1945 Strip Mine Tonnage	7/1/45–6/30/46 Strip Mine Tonnage	1946 Estimated Strip Tonnage
Pennsylvania	26,675,095		29,342,604
West Virginia	12,894,391		13,187,120
Ohio	12,935,513		11,714,477
Illinois	17,011,196		14,131,000
Indiana	13,376,621		11,600,000
Kentucky	6,484,605		6,873,681
Maryland	228,502		Not available
Oklahoma	.....	1,631,768	
North Dakota	1,687,069	1,996,096	
Missouri	No report		
Kansas	No report		

equipment (which a few manufacturers were able to build) in order to rework old territory and the development of new stripping areas. While the use of much larger equipment began prior to 1946, several new shovels and 20 to 25-yd. draglines were put into service thus lengthening the life of many heretofore worked-out properties. This, of course, added materially to the available stripping coal throughout the nation and because of the rapid advance in design and development of large machinery, it would be folly to try to estimate the end of strip mining in this country. The use of a hopper and disposal conveyors with large draglines is coming to the front and may revolutionize overburden removal. For soft overburden the wheel type excavator is soon to come from its field trial and probably go into production. New drills are now in production that should revolutionize one of the industry's most costly departments—drilling and shooting.

More Attention Now Paid to the Quality of Coal Produced

Preparation is destined to improve greatly throughout the nation with the continued installation of cleaning plants in areas where competition is keen. Ohio is probably the foremost state with this change going into effect. Operators in other states have specifications for their plants on paper and will undoubtedly follow this trend shortly.

In pre-World War II days, all producers learned the necessity of a good merchantable product. During the war this was kept in mind as production figures soared. Those operators who kept an eye on quality first during the war will be rewarded consequently with continued markets while others who loaded carelessly will no doubt pay for their negligence. An immediate drop in consumption is not anticipated at this time, but it will no doubt come fairly soon.

New Territory

Nearly everywhere in coal territory the traveler encounters someone poking holes in the ground. As mentioned before, the development of greater capacity machines has brought forth a great future for strip mining and territories that heretofore have been branded as uneconomical are coming to the front. West Virginia, for instance, has great possibilities and quite a few companies are investigating likely deposits. Ohio and Kentucky are by no means "sold out." Since the beginning of strip mining prior to the first world war, no figures have ever been compiled as to the quantity of strip coal available in the U. S. because every year brought changes in machinery and methods with consequent opening of new fields previously considered as uneconomical. It has often been asked, just how high can one strip? Of course, the quick answer is misleading. One can strip until costs catch up with profits. As these two factors are constantly changing, the solution of the problem is not simple. But the answer to this question has been the fundamental factor in the development of new fields all over the country.

Coal from these reserve stokpiles in Powerton, Ill., helped avert shutdown of vital power plants and manufacturing facilities during the recent coal strike.

ANNUAL REVIEW and FORECAST

Bituminous Coal

By CLOYD M. SMITH
Consulting Engineer
Washington, D. C.

THE first post-war calendar year, 1946, proved to be a dramatic year for bituminous coal. John L. Lewis, not content with a traditional spring strike which lasted nearly two months in April and May, struck again in the fall, November 20. The April strike ended May 22 with Government seizure of the mines, while the November strike ended in defeat for Lewis December 7. Attempts were made to get the mines back into the hands of their owners during the summer but they failed, so the November strike was against the Government and Lewis soon found he had met his match in an adamant administration. When he capitulated, he had gained nothing for his men and had subjected himself and his union to contempt proceedings and to consequent fines.

There was a significant contrast between the spring and fall strikes in that the earlier shutdown virtually throttled the industry, whereas production averaged 16.5 per cent of the pre-strike rate for the two calendar weeks of the fall strike. The comparative data are shown in Table 1. It is apparent that UMW control was less effective in the second strike, a fact which was evidenced by slowly increasing production during the first week in December when Lewis called the strike off. Increasing production and growing dissatisfaction in UMW ranks were potent factors in the capitulation, but behind these obstacles lay the avowed intent of the administration to break the strike by force if necessary.

The bituminous fields of Pennsylvania were the heaviest contributors of coal during the last week of the strike, with 478,000 tons. This was 21.1 per cent of the national production of 2,270,000 tons for that week, a normal proportion for Pennsylvania. Most of the Pennsylvania strike output came from strip mines, and strip mining contributed heavily to strike output in northern West Virginia, second largest strike producer. In Illinois, third heaviest strike producer, most of the output came from underground mines under the Progressive Miners of America. Detailed data of strike production are given in Table 2, which shows that tonnage was increasing during the strike in most of the leading coal producing states. The notable exceptions are Indiana and northern West Virginia, where output was decreasing.

The Danger of Labor Monopoly—Its Effect on Production

The severity of the spring strike should be emphasized to illustrate the danger in labor monopoly. Production of bituminous coal declined for six successive calendar weeks from 850,000 tons in the week ended April 6 to 47,000 tons in the week ended May 11. Although organized labor has been a significant factor in the bituminous coal industry since World War I years, this was the first and

Straight from the Shoulder

"When he (John L. Lewis) capitulated, he had gained nothing for his men and had subjected himself and his union to contempt proceedings and consequent fines."

"Seizure of the mines by the government in May marked the beginning of a one-sided affair which promises to end only with expiration of the government's power to hold seized properties June 30, 1947."

"It is apparent that UMW control was less effective in the second (coal) strike, a fact which was evidenced by slowly increasing production during the first week in December when Lewis called the strike off."

TABLE 1

COMPARATIVE PRODUCTION DURING SPRING AND FALL STRIKES, 1946

(Production rates in millions of tons per week)

	Spring	Fall
Pre-strike rate	13.1	12.7
Average rate during strike	0.56*	2.1†
Strike rate as % of pre-strike rate	4.2	16.5

* For weeks ended April 6, 13, 20, 27; May 4 and 11.

† For weeks ended November 30 and December 7.

only time it succeeded in bringing the national output of bituminous coal below a million tons in any calendar week.

Seizure of the mines by the Government in May marked the beginning of a one-sided affair which promises to end only with expiration of the Government's power to hold seized properties June 30, 1947. The Navy got the unwelcome assignment of operating the mines on the strength of a supposedly good record it made in the oil strike. From the coal operator's standpoint the Navy showing has been anything but good. Government seizure May 22, 1946, made it a clear violation of the Smith-Connally Act for anyone to interfere with men who wanted to work but UMW representatives continued to call men out of mines during the first week of Government operation, before the Lewis-Krug agreement was handed down May 29. Although some of these work interferences were officially brought to the attention of Captain Collisson, then deputy coal mines administrator, no attempt was made by Navy or the Department of Justice to follow the reports or to punish the offenders.

The Stand of the Navy on Vacation Pay

The Navy has repeatedly misinterpreted the Lewis-Krug agreement adversely to the operators, particularly with respect to vacation pay. The 1945 contract, which expired March 31, 1946, required an employe to have completed a year's work with his employer to be eligible for vacation pay, whereas the Lewis-Krug agreement broke vacation payments down to a monthly accrual basis. In spite of the fact that the 1945 contract had expired and its terms had been fully met by the operators before the Lewis-Krug agreement was set up, the Navy took the position that the monthly breakdown of vacation pay was retroactive into the 1945 contract period. Although this position is clearly illegal, it was rammed down the operators' throats at a cost to the industry of millions of dollars.

Navy seizure of the Carter mines and Fox mine for Government account was a belated legalistic maneuver taken after President Truman had sounded the death knell of coal mine seizure. The larger and more outstanding case, that of the Carter Coal Company, hinged on refusal of James W. Carter, president, to pay the five cents per ton health and welfare fund to the designated custodian. He offered instead to sequester the money in a fund to be spent for the benefit of his employes under administration mutually agreeable between the labor and the management of his mines, but CMA Navy officials took the stand that he must contribute to the common pool like others, hence the seizure for Government account, and the socialization of the Carter mines. The Navy threatens other dissenters with similar fate, unless they kick into the fund, which totaled about $12,000,000 last month.

The Health and Welfare Report of Admiral Boone

Asked about appointment of the three trustees to administer the fund and the reasons behind the eight-month delay in their nominations, CMA executive officers are silent. It is impossible to say whether Lewis and Krug have been unable to find fingers tough enough to handle this hot potato, or whether they are going to outwait Government occupation and let Lewis fight out the disposal of the money with the operators. Possibly trustee appointment is being delayed to give everyone a chance to see what the health and welfare report of Admiral Boone will look like.

Some intimation of the nature of the report is gained from the following quotation from an address the Admiral gave before the house of delegates, American Medical Association, in Chicago, December 10.

"The apparent weaknesses in public health programs in the Nation's coal-mining regions are deeply disturbing. Elementary control measures, in many instances, are completely lacking. There are exceptions, of course, but I would guess that, as a general rule, coal mining communities, particularly in the more densely populated and heavily productive coal areas, are deficient in such essential measures as adequate water supply controls, proper disposal of sewage and garbage, reasonable safeguards against contamination from human and animal wastes, protection in food and milk handling, and insect and rodent control measures. Although a number of coal-mining communities owned and operated by the larger and more progressive coal companies seem to be as sanitary and healthful as our better incorporated cities, they are too few in number and stand out as exceptions to the rule."

On interview, the Admiral proves to be a gentleman and a scholar who knows what he is doing. With a background of youth in the anthracite industry and long experience in the industrial aspects of naval medicine he prescribed for his staff close contact with the coal miner in his working and living setups. The Admiral took his own medicine by going underground to observe actual working

TABLE 2

OUTPUT BY STATES BEFORE AND DURING FALL STRIKE

(Production in thousands of tons for leading states)

	Pre-strike Week Ended Nov. 16	Strike Week Ended Nov. 30	Strike Week Ended Dec. 7	(+) Increase (—) Decrease	% of Total Week Ended Nov. 16	% of Total Week Ended Dec. 7
Alabama	344	28	36	+	1.4	1.6
Colorado	157	4	14	+	0.2	0.6
Illinois	1,310	278	357	+	13.6	15.8
Indiana	537	32	29	—	1.6	1.3
Kansas and Missouri.	125	38	51	+	1.9	2.3
Kentucky—eastern ..	1,240	68	68		3.3	3.0
Kentucky—western ..	471	237	297	+	11.5	13.1
Ohio	787	98	108	+	4.8	4.8
Pennsylvania (bituminous)	2,944	478	478		23.3	21.1
Tennessee	132	13	21	+	0.6	0.9
Utah	146	1	1		...	...
Virginia	398	23	38	+	1.1	1.7
West Virginia—southern	2,442	58	60	+	2.8	2.6
West Virginia—northern	956	462	417	—	22.6	18.6
Wyoming	234	8	8		0.4	0.4
Other states	417	224	287	+	10.9	12.2
Totals.....	12,640	2,050	2,270	+10.7%	100.0	100.0

conditions and by visiting homes, schools, offices and stores in many mining communities. Although never a family practitioner he holds the point of view of the family doctor, and he treated the coal industry as a patient to be examined, observed for objective symptoms, queried for subjective symptoms and diagnosed from the broader health standpoint. He regards his forthcoming report as an index to the industrial health of the coal industry, not as a compendium or total answer, and feels that it is auspicious that the first nation-wide survey of industrial health has been made in an industry as basic as coal. While the Boone report will not be wholly palatable, it should be of long run benefit to the industry and the nation.

Export Demand for Coal Expected to Continue in 1947

A strong export demand for coal is among the favorable factors for 1947. This was marked by continuation of the Treasury Department's procurement program well beyond its expected termination last year, with 773,000 tons designated by Treasury for export in January, 1947. As commercial shipments have been larger than Treasury shipments recently, total exports probably exceeded 2,000,000 tons last month. In December, 1946, the total was 1,647,130 gross tons, the equivalent of 1,850,000 net tons of 2,000 lbs. Table 3 gives data concerning distribution of shipments. Baltimore led as a loading port in December with slightly more than a half million tons. Philadelphia was a close second.

TABLE 3—DISTRIBUTION OF DECEMBER, 1946, EXPORTS

(In thousands of gross tons)

Country	Shipment M tons	Shipment %	Allocation M tons	Allocation %*
France	450	27.3	450	100
Italy	309	18.8	366	84
Belgium	196	11.9	196	100
Denmark	99	6.0	136	73
Netherlands	94	5.7	170	55
Sweden	81	4.9	127	64
Africa	80	4.8	85	94
Brazil	80	4.8	119	67
Norway	59	3.6	68	87
Portugal	53	3.2	53	100
Other countries	146	9.0	...	...
Total	1,647	100.0	...	...

* Per cent of reference country's allocation.

For the 17-month period, beginning August 1, 1945, which marked the inauguration of the export program, coal shipments to liberated areas of Europe averaged 1,150,000 gross tons per month while those to other European countries and Africa averaged 676,000 gross tons monthly. Europe is importing about 40,000,000 tons of coal a year, more than half of which is coming from the United States. At this rate the United States is supplying about a fourth of Europe's prewar imports. Five hundred Liberty ships are engaged in this traffic.

The effect of the 1946 strikes on stocks of bituminous coal is shown in Table 4. There was a sharp drain from 58.5 million tons at the end of March to 31.6 million tons at the end of May, a reduction of 56 points in the 1945 index. As if in direct preparation for the fall strike, stocks rose continuously from the May-end low to a new high of 54.9 million tons at the end of October.

TABLE 4—STOCKS HELD BY CONSUMERS, BY MONTHS, IN 1946.

Stocks of bituminous coal and lignite in hands of commercial consumers and in retail dealers' yards at month end, in millions of tons. Index, 1945, average of 48.5 million tons equals 100.0

1946	Stocks	Index
January 31	46.5	96
February 28	51.2	106
March 31	58.5	121
April 30	38.7	80
May 31	31.6	65
June 30	37.8	78
July 31	43.6	90
August 31	48.0	99
September 30	52.4	108
October 31	54.9	113
November 30	52.4*	108
December 31	50.0†	103
	565.6	

Average per month, 47.1

* Preliminary.
† Private estimate.

The record of stocks of bituminous coal and lignite throughout the war and early post-war period is shown in Table 5 which tells a story of depletion in the reserves of fuel in the hands of consumers and a story of decreased diversion of production into stocks. During the first two years of American participation in the war (1942-43) some 12 per cent of the annual output was carried in stocks, but the proportion had fallen to nearly 8 per cent by the end of the war. Need to rebuild stocks is a constructive factor for 1947.

A year ago predictions for 1946 output of bituminous coal ranged between 500 and 600 million tons but the spring strike soon dimmed prospects for the top figure and prolongation of the fall strike would have threatened the bottom figure. Preliminary data indicate that the year's production totaled 532 million tons, 7.9 per cent less than the 1945 output of 578 million tons.

A Coal Production Comparison in Two World Wars

Many economists feel that general industrial activity is following the World War I pattern. In spite of the danger of being deceived by a false analogy, there is an urge to draw comparisons in behavior of the bituminous coal industry during the two world war periods. Essential

TABLE 5—AVERAGE STOCKS IN RELATION TO PRODUCTION, 1942-46

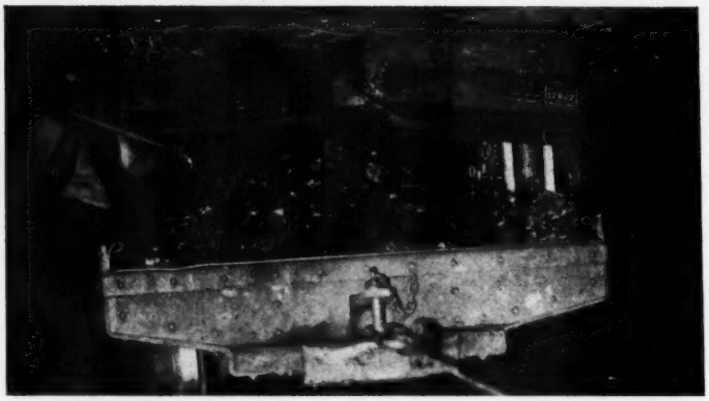
(In millions of tons)

Year	1942	1943	1944	1945	1946
Average stocks at month ends	73.7	72.7	58.2	48.5	
Year's production	582.7	590.2	619.6	577.6	532
Stocks as per cent of production	12.6	12.3	9.4	8.4	

TABLE 6—COMPARISON OF PRODUCTION OF BITUMINOUS COAL, WORLD WARS I AND II. ANNUAL PRODUCTION IN MILLIONS OF TONS. INDEX, 1910-13 AVERAGE EQUALS 100

	World War I			World War II		
	Year(s)	Production	Index	Year(s)	Production	Index
Four-year pre-war period	1910-13	437.8	100	1935-38	401.2	91
Outbreak of war	1914	422.7	97	1939	394.8	90
European warfare	1915-16	472.6*	108	1940	460.8	105
America's entry into war	1917	551.8	126	1941	514.1	117
Full years of American participation	....	....	...	1942-44*	597.5	137
War's end	1918	579.4	132	1945	577.6	132
First post-war year	1919	465.9	106	1946	532	121
Second post-war year	1920	568.7	130	1947†	503	115
Third post-war year	1921	415.9	95	....	....	...
Fourth post-war year	1922	422.3	96	....	....	...

* Annual average.
† Index and tonnage postulated to give same total production for first two post-war years as for 1919-20.



More than half of Europe's coal comes from American mines.

data on coal production in the two war periods are given in Table 6. Trends in production were similar except that the greater extent and intensity of World War II led to a larger volume of war fuel and to a higher peak in the indexes.

Behavior of coal production after World War I was too erratic to suggest a year-by-year parallel in production or indexes in the current phase. A strike in 1919 helped cut production more than 100 million tons below the war end level of 579 million tons, whereas the post-war year just concluded saw a reduction of only 46 million tons from the war end rate. In 1920 there was a sharp recovery of 100 million tons over the 1919 dip, but it is hard to foresee 1947 tonnage topping that of 1946, so a parallel may be sought in the total production for the first two post-war years. On this basis 1947 output will be 503 million tons as shown in Table 6. This would represent a 5.4 per cent reduction from the 1946 tonnage. A shrinkage in output fits in with the recessional tone of economic predictions. However, the 1947 recession has been so widely advertised that it may have been largely discounted and hence may not cut deeply into coal requirements. If this proves to be the case, factors that favor production (Table 7) should hold the 1947 tonnage above the 503 million ton figure, which is indicated by the post-war patterns.

Prices were surprisingly stable during 1946 considering the fact that price controls were lifted at the end of June, reimposed late in July and lifted again in November. A few days before OPA expired, June 30, it granted price increases which were supposed to offset the increased costs imposed by the Lewis-Krug agreement. Typical increases follow:

District	Increase, cents/ton
7. Southern numbered 1	58
8. Southern numbered 2	46
9. Western Kentucky	19–30
10. Illinois strip mines	10–20
Illinois underground mines	25–45
11. Indiana	35

Table 8 indicates that the industry has policed itself well with respect to price increases since the demise of OPA. Many companies have raised their quotations on stoker coal but there have been comparatively few changes in prices of other sizes. It is unfortunate that pyramiding costs for wages and trimmings required by the Lewis-Krug agreement have forced any price increases but it is particularly unfortunate with respect to stoker coal, for that hits sales of domestic fuel where coal is most vulnerable to competition. Fortunately, improving productivity in terms of tons per man hour promises to enable the industry to overcome mounting labor costs in some degree and thereby to hold a major share of its markets. The industry can be expected to make further progress in this direction in 1947.

TABLE 7.—FACTORS WHICH AFFECT OUTLOOK FOR BITUMINOUS COAL

Favorable:

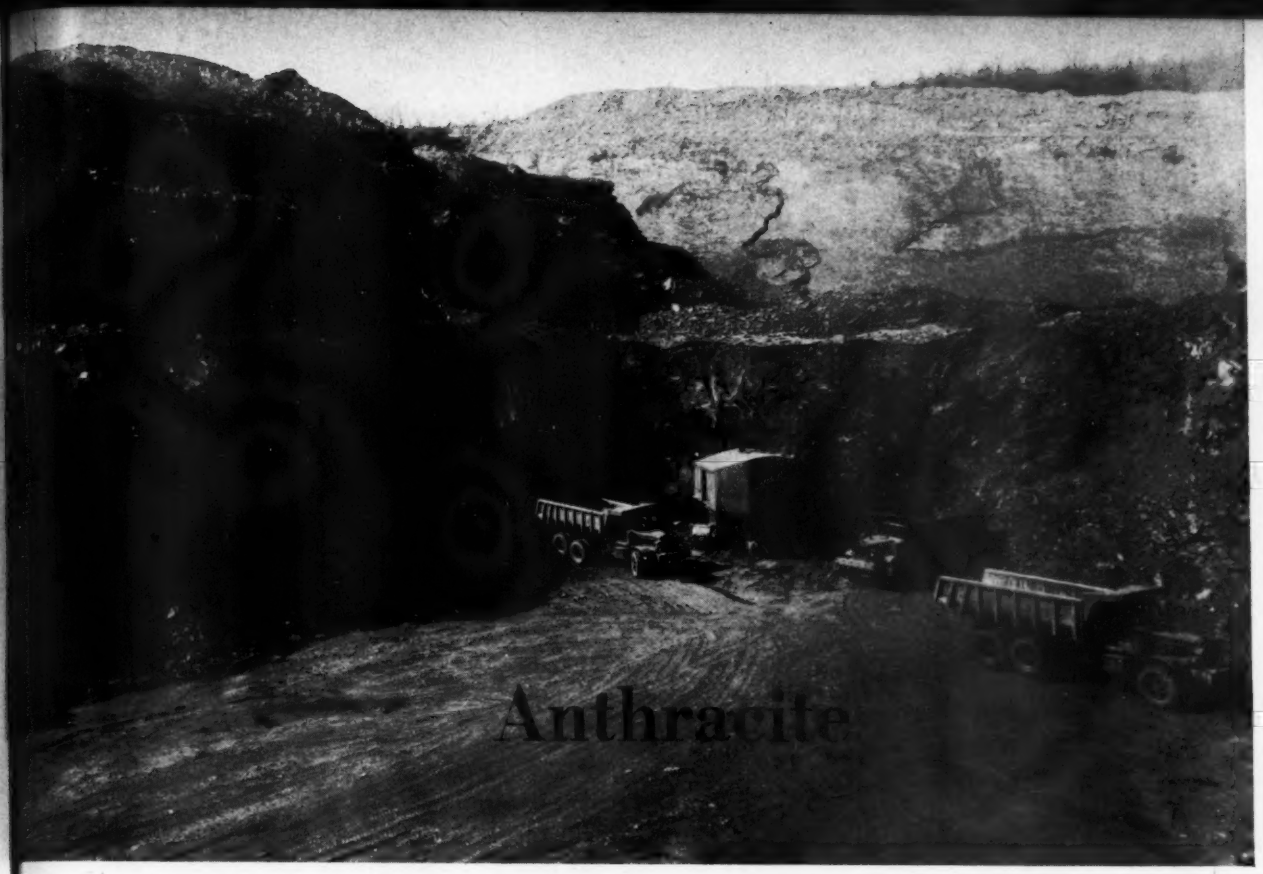
A. High level of industrial activity.
B. Unsatisfied demand for durable goods.
C. Acceleration of building program.
D. High consumer buying power.
E. Strong export demand supported by poor outlook for British production of coal and continued inability of European mines to meet demands.
F. End of Government possession and regulation.

Unfavorable:

A. Threat of repetition of 1946 wave of strikes in other industries.
B. Threat of renewed strike in coal April 1.
C. Danger of split between northern and southern operating groups.
D. Increased operating costs.
E. Increased competition.
F. Danger of declining prices (favorable to the extent that it helps combat competition without wiping out profits).
G. Higher freight rates on coal.
H. Higher freight rates on other commodities (invite truck competition and diminished demand for locomotive fuel).
I. Increased dieselization of railroad motive power.
J. Development and application of atomic energy through Government subsidy.
K. Expansion of anti-smoke activities.
L. Loss of new home heating market to fluid fuels.

TABLE 8—PRICES ON LUMP AND STOKER SIZES, IN DOLLARS PER TON F.O.B. MINES AS REPORTED BY *BLACK DIAMOND*

	Lump	Stoker
January-June, 1946:		
Southern Illinois	3.40	3.10
West Virginia smokeless	4.00-4.65	3.75
High volatile	3.85	3.80
July-mid November, 1946:		
Southern Illinois	3.65	3.45
West Virginia smokeless	4.83-5.23	4.34
High volatile	4.31	4.01
Mid November-mid December, 1946:		
Southern Illinois	3.65	3.45
West Virginia smokeless	4.83-5.23	4.59
High volatile	4.31	4.01
Mid December, 1946-January, 1947:		
Southern Illinois	3.65	3.45
West Virginia smokeless	4.83-5.23	4.75
High volatile	4.31	4.01



Anthracite

★

By JOHN L. G. WEYSSER
Lehigh Navigation Coal Co.

★

THE anthracite producing district is situated in northeastern and eastern Pennsylvania and comprises four fields, namely: the Northern, Eastern Middle, Western Middle, and Southern Fields, as shown on the map (figure 1). In this district approximately 135 anthracite producing companies operated some 230 collieries and mines during 1946.

Production Increased But Demands Were Not Met

The production during the year increased approximately 8 per cent over that of 1945, which was the lowest since 1940. Table 1-A shows the estimated total commercial production and average number of days worked in 1946, and the actual data for some previous years for comparison. Table 1-B shows the total production for 1945 and for 1946, broken down for the several sources from the operations. The improvement in annual production was gratifying, but the demand still was not met. It is believed that in the history of the industry, the year 1946 presented the greatest opportunity for the betterment of its position. Eight days' production was lost because of strikes, with an estimated resultant loss of 1,750,000 tons. While this was a comparatively good record in these times of unsettled labor conditions throughout the nation, additional potential production was lost as a result of local strikes.

Costs, Prices and Market

The wage negotiations held in May and June brought forth an agreement which provided further increases in wage rates, and also required a royalty payment to provide a health and welfare fund. The top factor in the production of anthracite is, of course, the mine worker, and any circumstance which makes for betterment of his working conditions, earning capacity and security are to reflect improvement in the status of the industry as a whole. However, anthracite is in an unfavorable position with respect to certain of its competitors whose labor cost is a relatively small part of their total production cost. In anthracite, upwards of 65 per cent of the cost of putting a ton of coal on the railroad car for shipment to the market is a direct labor cost; hence, any increases in wage rates are immediately reflected in almost an equally high percentage increase in production costs. This, together with the added burdens of royalty payments, has necessitated increased market prices.

Table 2 shows the September, 1946, retail prices of two sizes of anthracite in five representative cities in the market territory. Such prices practically eliminate the strongest sales argument to the individual consumer against other forms of heating, namely: lower cost of household heat by use of anthracite. Yet the total demand far exceeded the production. But there was, in all businesses, a "seller's market," and furthermore, as of the end of October, more than five million tons of anthracite had been exported. (All indications are that even the 1917 export record will have been exceeded.)

In view of the foregoing, one wonders at the real security of the worker.

It should be noted that the prices shown reflect the increases to f.o.b. mine prices *allowed* by the Office of Price Administration on the basis of cost increases, and further, that the producing companies have not brought about any major changes in f.o.b. mine prices since the OPA controls were withdrawn.

Production Has Been Restricted by Manpower Shortage

During the past several years there has been some decline in the rate of coal production by faceworkers. The most pressing problem confronting the industry has been twofold: difficulty in obtaining a higher rate of output per manshift of faceworkers in proportion to the increase in wages, and difficulty in obtaining a sufficient number of faceworkers. The gravity of the problem is evident when it is considered that because of the occurrence of the coal seams (in synclinal basins with—particularly in the Western Middle and Southern Fields—steeply dipping flanks) the normal proportion of face workers to the total number of workers is between 35 and 45 per cent, the remaining workers being engaged in development work—much in rock, timbering, transportation and surface plants. In many operations the actual mining work had always been paid for on a piece-rate basis.

The exigencies of the war (and continued emergency conditions during the past year) made uninterrupted production of anthracite most urgent. There were several seizures and periods of operation of the collieries by the Federal Government because of strikes during the war. Both of these circumstances resulted in the operators' being forced to accept wage agreements (including that of June, 1946) which adversely affect the future of the industry. One feature has been the increasing of the minimum day rates to such an extent that performance incentive to the individual worker on a piece-work basis has been lessened. It is probable also that the nation-wide shortage of consumers' goods and the high individual income-tax rates are contributing factors. These circumstances practically nullify the now small margin of possible increased earnings obtainable through greater output on the part of the individual.

—U. S. Bureau of Mines

The anthracite region consists of four fields.

TABLE 1-A

TOTAL COMMERCIAL PRODUCTION OF PENNSYLVANIA ANTHRACITE AND AVERAGE NO. OF DAYS WORKED 1924, 1927, 1930 AND 1935-46

Year	Total commercial production [1] (in net tons)	Average number of days worked
1924.....	80,291,438	274
1927.....	73,542,056	225
1930.....	64,346,491	208
1935.....	49,412,799	189
1936.....	51,874,887	192
1937.....	49,184,535	189
1938.....	43,786,075	171
1939.....	49,073,355	183
1940.....	49,228,579	186
1941.....	54,107,222 [2]	203
1942.....	57,969,104 [2]	239
1943.....	58,269,569 [2]	270
1944.....	61,406,211 [2]	292
1945.....	52,816,315 [2]	269
1946.....	56,965,000 [2 3]	277 [3]

Source of data for years 1924-1945: U. S. Bureau of Mines.

[1] These data exclude that part of the total output which was used as colliery fuel.

[2] Excludes "bootleg" coal except that which was purchased by recognized operators for preparation and shipment to market.

[3] Estimated.

TABLE 1-B

ESTIMATED PRODUCTION, NET TONS, IN 1946 FROM VARIOUS TYPES OF ANTHRACITE OPERATIONS, AND ACTUAL DATA FOR 1945

	1945 [1 2]	1946 [2 3]
Bank	8,752,211	9,270,000
Stripping	9,974,592	11,600,000
Underground mine.....	34,820,565	37,030,000
River dredging.....	1,205,266	1,200,000
Total production..	54,752,594	59,100,000

[1] Source: Minerals Yearbook, United States Bureau of Mines.

[2] Estimated.

[3] Excludes "bootleg" coal, but includes colliery fuel.

TABLE 2

SEPTEMBER, 1946, PRICES OF CHESTNUT AND NO. 1 BUCKWHEAT ANTHRACITE

	Chestnut	No. 1 buckwheat
Boston	$18.42	$13.72
New York	17.14	11.93
Philadelphia	16.08	11.63
Buffalo	16.57	11.68
Washington, D. C..	16.14	11.60

Source: U. S. Department of Labor.

The foregoing together with a general shortage of face workers has undoubtedly restricted production. One observer states that a large operating company obtained an increase in overall production of 10 per cent in 1946 over 1945; however in 1945 production was the all-time low for that company. Further, the increase was obtained exclusively through more selective mining with attendant better yields, not as the result of bettered effort on the part of their men. In the Northern Field it is reported that thousands of available jobs—particularly miners and miner's helpers—remain unfilled. The manpower situation was not improved as was expected by the return of veterans to civilian life. A marked trend away from a desire to work underground was noticed. Even special training classes instituted by some of the larger companies did not seem to meet with much success.

"A new era in the development of closer employer-employe relationship in the Anthracite Industry was ushered in with the inauguration of meetings for the supervisory forces of anthracite producing companies. . . ."

Mine Operations Influenced by Equipment Shortage

In November, 1946 operation of the East Boston Colliery in Luzerne was discontinued. Aside from this and the usual cases of depleted or marginal sections, no important mines were abandoned. No important new mines were opened or old mines reopened during the year, with the exception of some cases of extension of workings into territory previously shut down.

Table 3 shows the number of new units of mechanical mining equipment put into service during the year and the total number of each of these classes in service as of the end of the year 1945. With the pressure for increased output resulting from the rising costs, a much greater percentage increase in the number of units in service would be anticipated. Inability to purchase equipment, a direct result of the strikes affecting the entire manufacturing industry of the country, undoubtedly retarded the trend.

Since the inception of mechanized mining in the anthracite region, most of this work has quite naturally been in the Northern Field, where large proportions of the active reserves occur as flat or nearly flat lying seams. However, the use of mucking machines and jumbos for rock development work was expanded during the year at a number of mines in the Southern and Western Middle Fields, where most of the active reserves are in steeply pitching seams.

TABLE 3

MECHANICAL MINING EQUIPMENT IN SERVICE UNDERGROUND IN PENNSYLVANIA ANTHRACITE FIELDS

	Units in service as of end of year, 1945 [1]	New units put into service during 1946 [3]
Cutting machines...	225	*
Scrapers and	568	32 [4]
mobile loaders...		5 [5]
Conveyors [2]	3,006	319

[1] Source: Minerals Yearbook, 1945, United States Bureau of Mines.
[2] Includes duckbills and other self-loading conveyors.
[3] Source: U. S. Bureau of Mines.
[4] Scrapers only.
[5] Mobile loaders only.
* Not available.

Pumping on the Increase

Pumping continues to be an important problem and has received a lot of attention in the Northern Field because of the large pools in abandoned and robbed areas. With the abandonment of pumping in the East Boston Colliery, the water normally handled by the former operator is now added to what is known as the Kingston Pool, where the Glen Alden, Lehigh Valley, and Hudson Coal Companies have a joint pumping agreement. Two deepwell pumps of 4,000 gallons per minute capacity each are being installed in the Kingston No. 4 shaft by these companies to hold the water at a low level in the adjacent territory so as to relieve the head against the barrier pillars separating this pool from operations of the participating companies.

There was considerable interest in the deepwell type pump and a number of installations of such equipment were made where conditions are adapted to their advantageous use. The Philadelphia and Reading Coal and Iron Company installed three units, each of 5,000 gallons per minute capacity.

A number of other installations of conventional equipment were made at greater depths. For example, the Susquehanna Collieries Company installed three additional stations, one of 6,000 gallons per minute capacity and the others of 3,000 gallons each.

The pumping problems eased considerably as a result of lower than normal precipitation in the latter months of the year. In the Scranton area (Northern Field) the precipitation was 36.70 in. as compared with 53.72 in. in 1945, and a normal of 38.69 in. The corresponding figures in Lansford (Southern Field) were: 1946, 47.76 in.; 1945, 59.30 in.; 40-year average, 44.89 in.

The Lehigh Navigation Coal Company developed refinements in pumping station layout whereby they are located at a higher elevation with respect to the shaft station than had been previous practice. Further refinements in design of emergency dams to withstand heads of approximately 100 ft. rather than 30 ft. have been of tremendous value in avoiding drownouts in periods of intense precipitation.

One-fifth of Production from Strip Operations

Stripping operations (open pit mines) continued to be an important factor in production of anthracite in 1946 when production from this source was approximately 20 per cent of the total production from collieries. The economic impetus from manpower and cost problems, and improved and increased excavating equipment are seen working to bring about increased depths of open pit operations. Table 4 shows the approximate data on new excavating equipment put into service during the year. Included were two 25-cu. yd. draglines; there are four such machines now in operation in the district. The paper given by R. M. Dickey, "Trend to Large Drag Lines," in the Cincinnati meeting of the American Mining Congress in April

TABLE 4

DATA [1] ON POWER SHOVELS USED IN STRIPPING (OPEN PIT) OPERATIONS, PENNSYLVANIA ANTHRACITE FIELDS

	New machines put into service during 1946		Total No. of machines in service Dec., 1946
	No. machines	Aggregate bucket capacity	
Small [2] draglines..	10	85 cu. yds.	250
Small [2] shovels....	27		
Large [3] draglines..	21	175 cu. yds.	200
Large [3] shovels....	13		
Total machines..	71	260 cu. yds.	450
Blast-hole drills...	60		250

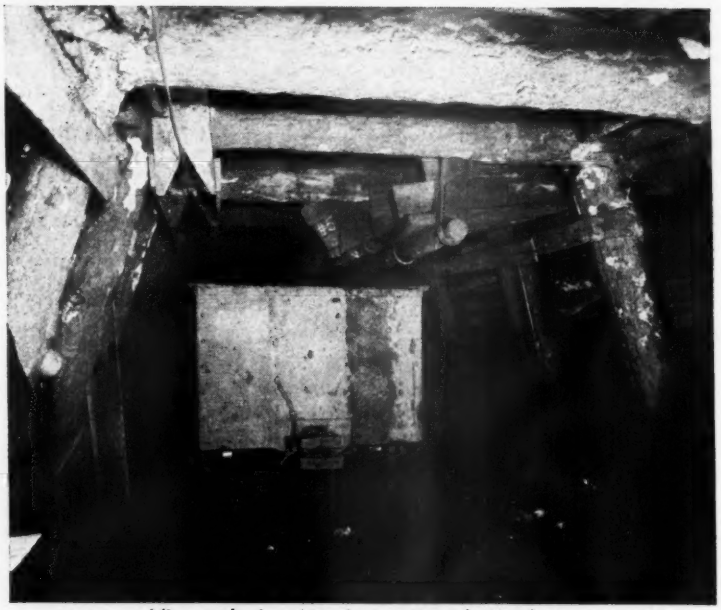
[1] Data are approximate.
[2] This designation covers machines with bucket capacities from ½ to 2 cu. yds.
[3] This designation covers machines with bucket capacities from 2½ to 25 cu. yds.

and recorded in THE MINING CONGRESS JOURNAL in June, is of interest in this respect. One manufacturer alone supplied over three and one-quarter million dollars worth of equipment for use in the anthracite industry during 1946.

"Bootleg Mining"—A Bad Situation

The depression-born activity called "bootleg mining" started with unemployed mine workers' sinking holes on the outcrops of coal seams in remote idle or abandoned coal lands, and mining the crop or barrier pillars. Subsequently there was an influx of outsiders who erected small crude breakers and purchased the run-of-hole coal; with this development, the activity grew to alarming proportions. An emergency committee did much to bring the problem under control.

While originally such mining constituted trespassing of property rights, the majority of the men so engaged at present are within their rights from a technical legal standpoint, since they are paying royalties, for coal removed, to those technically in control of the lands involved (the properties in many cases having changed hands). However, the problem is far from solved, for it is regrettable that this activity is again on the increase as shown in Table 5-A. The fact that this is happening should concern every citizen of the region for this is not exclusively a problem of the legitimate anthracite producers, but is a threat to the welfare of the entire district. It impairs the market position of anthracite because the bootleg product is poorly prepared. Further, it does not cover its employes with unemployment compensation nor Social Security; it does not pay its share of taxes; it operates non-union; it is destructive to surface improvements; it makes future mining hazardous and costly; and, finally, the operations are not carried out according to the State Mining Safety Code with the result that the fatality rate is far too high. Table 5-B shows the fatal accident statistics.



Mine car haulage is an important production factor

TABLE 5-A

NUMBER OF "BOOTLEG HOLES" AND MEN WORKING THEREIN AT DIFFERENT DATES

Date	Number of Holes	Number[1] of Men
March, 1941.....	3,006	10,762
May, 1942.....	2,029	7,554
April, 1943.....	1,065	3,607
March, 1944.....	652	2,220
March, 1945.....	502	1,806
August, 1945.....	445	1,676 *
March, 1946.....	526	1,939
December, 1946...	892	2,915

[1] Exclusive of truckers and breakmen.
* Low point.

TABLE 5-B

TOTAL PRODUCTION AND FATALITIES IN "BOOTLEG" OPERATIONS FOR THE LAST SIX YEARS

	Production	Fatalities	Production per Fatality
1941.....	6,300,000	61	103,279
1942.....	3,930,578	45	87,346
1943.....	1,924,110	22	87,460
1944.....	1,332,957	21	63,474
1945.....	1,026,000	16	64,125
1946.....	1,448,529	19	76,238

Safety

The industry continued to show an improved safety record over that of earlier years. While an increased percentage of the total production has come from stripping and bank operations which involve somewhat less hazard, nevertheless the industry has accomplished much, as shown in Table 6, and is again giving increased attention to safety matters.

TABLE 6

PRODUCTION PER FATAL ACCIDENT, ANTHRACITE REGION—1928 TO 1946

1928.....	166,784	(5.3%)[1]
1932.....	203,710	(9.3%)
1935.....	192,356	
1938.....	207,487	(15.3%)
1941.....	285,408	
1942.....	257,509	
1943.....	277,577	(27.00%)
1944.....	374,927	
1945.....	408,038	(35.7%)
1946.....	380,000	Estimated

[1] Stripping and bank coal.

New Installations of Preparation Plants Continue

Difficulty in obtaining materials during the year made maintenance a serious problem. While this problem affected underground operations to some extent, it was especially pronounced in connection with maintenance of preparation plans where the replacement requirements for sheet steel and chain were high and shortages of items such as these made uninterrupted and proper operation of the breakers quite difficult. Much work was done to neutralize the water used in breakers and to apply stainless steel in the manufacture of parts in order to cut down on the maintenance resulting from corrosion. Use of glass for lining coal chutes became more general.

Several installations of new plants and major additions to preparation facilities in existing breakers are worthy of mention. The Hudson Coal Company began construction of a silt cleaning plant equipped with spiral separators, at Powderly Colliery. The company also has under way considerable revamping work in their Olyphant and Loree breakers; this work is still in progress. The Centralia Mining Company built a plant equipped with a 12-13½-ft. dense-media cone and hydrotators. A 200-ton per hour dense-media cone was

installed in the Weston Breaker of the Locust Coal Company and a 100-ton per hour unit in the plant of the Wadell Coal Company in Archbald. It is interesting to note that a plant being built by the Markson Coal Company will be equipped with a cleaning system functioning on the principle of the Rheolaveur. Indicative of the trend toward recovery and preparation of the finer sizes are the installations made at the Philadelphia & Reading Coal & Iron Company's St. Nicholas and Locust Summit central preparation plants and at their Oak Hill Colliery, at all three of which sizable additions were made for preparing No. 4 and No. 5 buckwheat. This trend is further evidenced from the data in Table 7.

The industry's second froth flotation plant was put into service, having been constructed by the Susquehanna Collieries Company at Nanticoke, Pa. This plant is equipped with ten rougher and eight cleaner cells and has a normal capacity for preparing 30 tons of minus 28 mesh material per hour. Considerable expenditures were made on installations to reduce further and eliminate the influx of silt into the streams.

Two briquetting plants were built by the RFC adjacent to the Philadelphia & Reading Coal & Iron Company's Locust Summit and St. Nicholas Central Breakers respectively. The Locust Summit plant started production in March and the St. Nicholas plant in July. The bulk of the coal, No. 4 buckwheat and smaller, which is used in making the briquets comes directly from the Central Breakers. The daily capacity of each plant is 1,000 tons and during the period of operation in 1946 the production was 267,000 tons. The plants are being operated by the American Briquet Company for the Reading Briquet Company under lease with the Government.

"One manufacturer alone supplied over three and a quarter million dollars' worth of equipment for use in the Anthracite Industry during 1946."

Freight Rates

Early in 1946 the railroads of the United States petitioned the Interstate Commerce Commission for a general increase in rates and charges in all classes of traffic. A temporary increase was subsequently granted but the anthracite industry presented testimony opposing any increases greater than those imposed on bituminous coal. On December 7, 1946, the Commission granted increases which were equal for both coals.

Motor compelled rates which were to expire November 20, 1946, were again extended by the carriers until March 20, 1947. After nine years of litigation, the Interstate Commerce Commission finally was upheld by the United States District Court in its order reducing rates of anthracite 25c per gross ton to New York tidewater piers. This order became effective in August.

Anthracite Institute, Research and Utilization

On January, 1, 1946, Anthracite Industries, Inc., was merged with Anthracite Institute, which now stands as the only industry organization. In June, 1946, Anthracite Institute moved into its newly acquired building in Wilkes-Barre, and shortly thereafter the laboratory was transferred from Primos to the new location. Thus, with the exception of the headquarters in New York of the field representatives and the public relations department, all activities of the Institute are permanently centered in Wilkes-Barre.

The laboratory, with increased facilities for research work at its new location, continued its work in basic and applied research in addition to its test work on anthracite-burning equipment of all types. A successful test on the use of oxygen with an anthracite gas producer, to yield a raw synthesis gas suitable for use in

New preparation plants are being installed and old ones renovated

synthetic ammonia, synthetic methanol or synthetic gasoline processes, was completed at Trail, B. C. Field tests in three anthratube designs were completed during the heating season 1945-1946 and commercial models of the Anthratube will be available during early 1947.

In addition to the research in the laboratory, the anthracite industry continues to sponsor research at the Mellon Institute and at Pennsylvania State College.

In order to associate anthracite with the great public interest in new homes, the "Answer Home" campaign featuring the anthracite Simpli-Fire room was given wide publicity all through the anthracite-burning territory. Institute field representatives have conducted a number of merchandising schools for retailers and their employes in key cities. These schools will continue during 1947.

A new era in the development of closer employer-employe relationship was ushered in with the inauguration of meetings for the supervisory forces of producing companies, held at the new Anthracite Institute Building in Wilkes-Barre. Before the meetings are completed 5,000 men, comprising the colliery superintendents, mine foremen, section foremen, outside foremen, fire bosses, department heads and officials of each local of the United Mine Workers of America will have attended the meetings.

Active opposition to the St. Lawrence power and navigational proposal was continued by the Anthracite Institute together with shipper, transportation, business and labor interests throughout the country generally. The Institute and other coal, railroad and labor interests also actively opposed a welter of natural gas construction and expansion applications filed with the Federal Power Commission involving threatened intrusion of natural gas into anthracite-burning territory. The Anthracite Institute also appeared and offered testimony and exhibits before the Federal Power Commission in its general investigation of the natural gas industry, from exploration to ultimate consumption. These hearings were concluded in the early fall, and briefs were submitted in October. The Institute has also been vigilant in the matter of the ultimate disposition of the Big Inch and the Little Inch pipelines, which were built during the war to transport petroleum and its products to the eastern seaboard territory. The matter of future use of these lines for the movement of natural gas has been a controversial one for many months, and at this writing, further hearings are being held before the House Surplus Assets Committee.

Just as the anthracite industry did an outstanding job during the war, it has met vigorously the problems which 1946 brought, and faces the future with determination. Cooperation of all segments of the industry is most important to its future. It is very encouraging to see increasing signs of such cooperation.

The writer is indebted to those who provided facts and data from which this article was prepared.

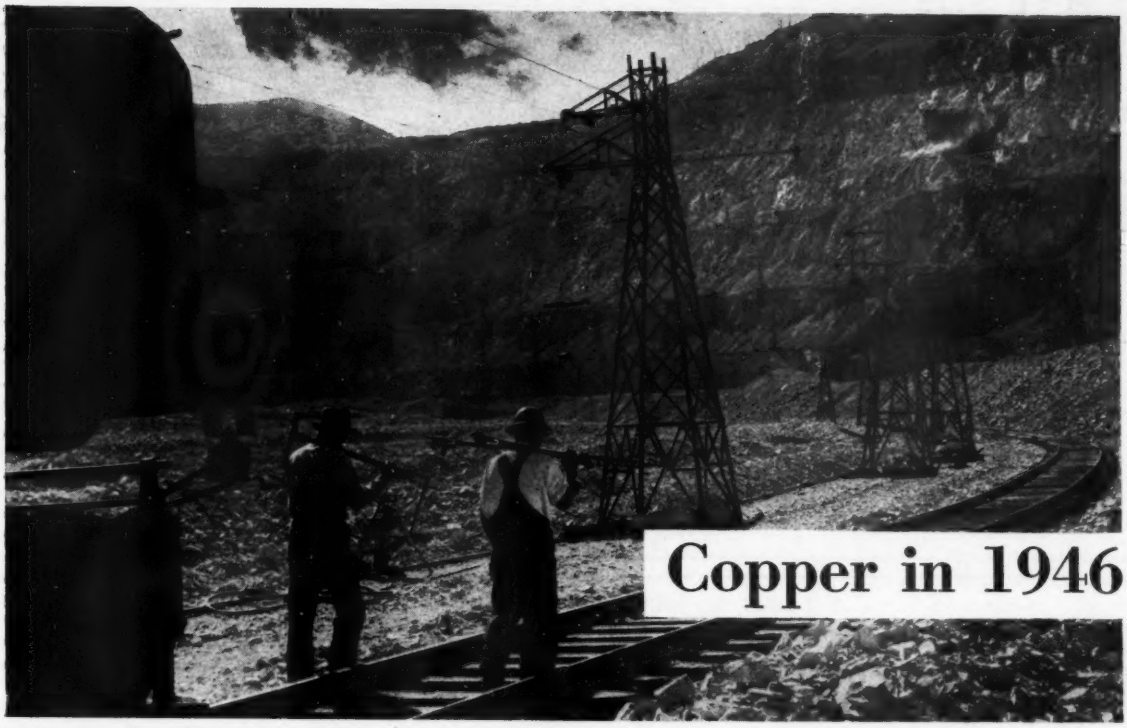
TABLE 7

NEW PREPARATION EQUIPMENT INSTALLED IN ANTHRACITE OPERATIONS IN 1946 *

Equipment	Sizes Cleaned	Number of Units Installed	Hourly Capacity, Tons
Jigs	Pea and larger [1]	11	275
Cones and Classifiers	Pea and larger	7	690
Tables	No. 1 Buckwheat [2]	5	70
Classifiers	No. 1 Buckwheat	6	150
Tables	Rice [3]	3	36
Classifiers	Rice	4	100
Tables	Barley [4]	1	10
Classifiers	Barley	6	120
Tables	No. 4 [5] and/or No. 5 Buckwheat [6]	47	380
Classifiers	No. 4 and/or No. 5 Buckwheat	5	75

(All sizes are round mesh.)

* Data are aproximate.
[1] Nominal size: over 9/16 in.
[2] Nominal size: through 9/16 in., over 5/16 in.
[3] Nominal size: through 5/16 in., over 3/16 in.
[4] Nominal size: through 3/16 in., over 3/32 in.
[5] Nominal size: through 3/32 in., over 3/64 in.
[6] Nominal size: through 3/64 in.



Copper in 1946

Strikes, Labor Shortages, and Price Uncertainties Influenced Last Season's Output. For the First Time the United States Became a Copper Importing Nation in Other Than a Wartime Period. 1947 Outlook More Favorable for the Producer

By JAMES DOUGLAS
Phelps Dodge Corporation

DURING the year 1946 the copper industry passed through a difficult but nonetheless interesting period characteristic of the entire American economy. The year was marked by labor unrest and by strikes, by price uncertainties due to Government price control continuing into the postwar era, and by steep price rises once the regulating hand of the OPA had been lifted and the RFC had announced its withdrawal from the copper market abroad. 1946 was also unique in that for the first time in history the U. S. became clearly a copper importing nation in other than a wartime period. This fact raised many questions, the principal one of which revolved around tariff considerations and the industry perforce kept a vigilant eye on production, consumption and price in the foreign field.

The last four months of 1945 following the defeat of Japan and the end of World War II had served to dispel the fears held by many in the copper industry that domestic copper consumption would decrease to a disastrously low level with relation to peak wartime demands. As the industry entered the new year a consumption pattern of unprecedented peacetime magnitude had been already established. Every indication pointed toward its continuance through 1946 and for an indefinite period in the future.

On the production side the threat of strikes, the severity of which no one could anticipate at that time, clouded the horizon but the downward trend of production and manpower had been halted. Nevertheless, indications were that domestic copper output would fall far short of satisfying demand. From a peak production figure of 1,207,000 tons* in 1943 refinery output from domestic ores, concentrates and other materials had decreased to an annual rate of 821,000 tons* for the three months November and December, 1945, and January, 1946. These months represented the last period prior to the virtual industry-wide strikes which played such havoc with domestic output. Total deliveries during the same three months were at the annual rate of 1,356,152 tons. Because of Government inventory restrictions and the economy's aching hunger for copper for actual use and for the filling of pipe lines, delivery figures applicable to this period and throughout 1946 are about identical to consumption. Therefore, even before the disruption of the industry by strikes, shortage of domestic supply over demand was apparent as was the continuing need for RFC allocations of copper to the economy to satisfy the deficit.

R. F. C. Stocks Drained During Period of Strikes

Commencing in January, strikes at the principal refineries, the latter soon thereafter spreading to mines, mills and smelters, paralyzed the industry, copper refinery output from domestic sources, decreasing to a low of 18,989 tons in the month of April.

* As reported by the Copper Institute.

TABLE "A"

United States Copper Statistics (In tons of 2,000 Pounds)

Column:	(1)	(2) DUTY-FREE COPPER	(3)	(4)	(5)
	Refined Production	Changes in Ref. Stocks	Deliveries to Customers	Total Deliveries to Customers	Deliveries from MRC Stocks
	(a)	(a)	(b)	(a)	(c)
1946					
January	69,008	— 3,713	72,721	115,601	42,880
February	49,923	+ 1,540	48,383	86,089	37,706
March	20,139	— 4,090	24,229	58,590	34,361
April	18,989	— 4,801	23,790	75,756	51,966
May	20,551	+10,306	10,245	93,647	83,402
June	23,870	+ 3,391	20,479	95,267	74,788
July	43,606	+22,038	21,568	96,826	75,258
August	59,591	— 6,514	66,105	118,814	52,709
September	67,803	+ 3,950	63,853	113,158	49,305
October	77,947	— 7,458	85,405	136,481	51,076
November	75,066	— 265	75,331	129,206	53,875
December					

Note: (a)—As reported by the Copper Institute and published in *Metals.*
(b)—Column (1)±Column 2.
(c)—Column (4)—Column (3).

TABLE "B"

Employment in Copper Ore Mining

1945	No. Men	1946	No. Men
November	19,000	May	15,500
December	19,700	June	14,700
		July	20,400
1946		August	21,200
January	20,500	September	21,500
February	17,900	October	21,800
March	17,800	November	(Not
April	15,300	December	available)

Production strikes were paralleled by a curtailment of demand by copper consumers due to the same cause. Hence, the effect of decreased output was partially alleviated by the fall off of demand during the same period and by the fact that the strikes themselves hindered actual shipment of refined copper from plants. However, the RFC copper stocks were heavily drained during the strike period, the highest single month being May in which 83,402 tons were delivered from RFC inventory. Chart I shows the depletion of the RFC stockpile during the first eleven months of 1946. Chart No. II illustrates the total tonnages of copper delivered to consumers from January through November, 1946. Also shown on the chart is refinery production from U. S. mines and secondary materials and tonnages of copper released by the RFC to copper consumers to balance the deficiency between domestic production and consumption (deliveries). Tabulation "A" shows the figures on which Chart No. I is based and the notes accompanying the tabulation explain the manner in which the tonnages of RFC copper deliveries were calculated.

Manpower Shortage Less Critical at Year's End

For the most part labor difficulties at mines, smelters and refineries were settled during June and production from that time forward began its climb upward, the limitation of eventual peak output being that of the availability of labor. Employment in copper ore mining for the first nine months of 1946, as prepared by the Bureau of Labor Statistics, is shown in Table B.

Employment figures for the copper smelting and refining industry alone are not available. However, labor shortages were not sufficiently serious to markedly affect copper output from this end of the copper producing industry. For purposes of comparison the average number of men employed in mining during the years 1942, 1943, 1944 and 1945 were 32,100; 31,400; 25,900; and 20,500 respectively. Previous to mid-1946 the low point had been reached in the month of September, 1945, when 18,800 men were employed. By January, 1946, therefore, labor had begun to return to the mines at an encouraging rate. During the strike period although manpower was not a consideration some labor no doubt drifted away from the copper camps. Because of the difficulty of companies accurately reporting employment, the figures as tabulated in Table "B" are probably low for the months of February to June inclusive. It is reasonable to suppose, however, that approximately 2,000 men were lost to copper mines during the months of the shut-downs. The mines returned to full operation if not production by the end of July, in which month labor employment was reported at 20,400 men, about the same number as were employed in January prior to the commencement of the mine shut-downs. By August a sizeable number had returned and the trend continued upward in September and October,

COPPER IN METALS RESERVE STOCKPILE

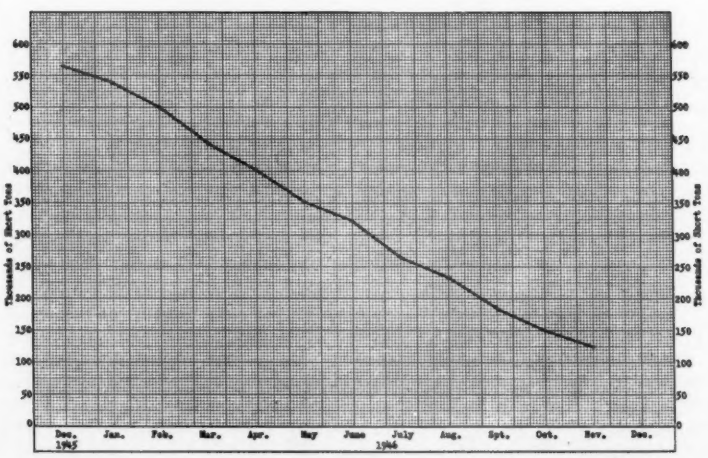


Chart I

One space=5,000 short tons. As announced by RFC and published in the press. Includes copper in process but excludes stocks located outside U.S.A.

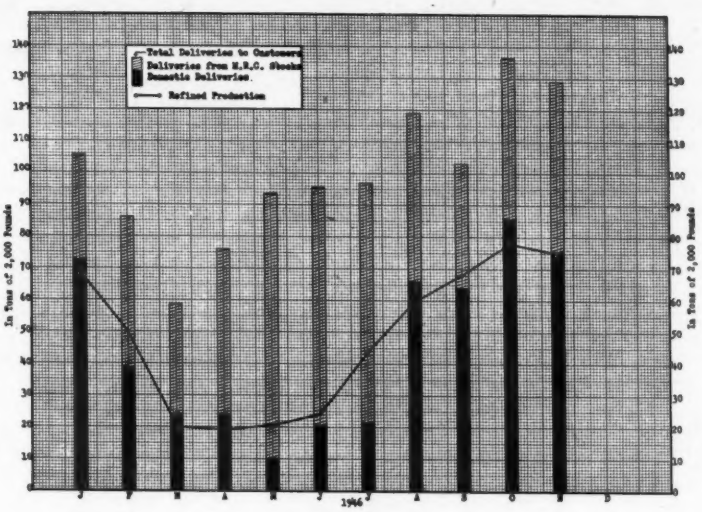


Chart 2
United States copper statistics for 1946

the last months for which Bureau of Labor Statistics figures are available. Moreover, it is believed that the improvement in the number of workers noted since the resumption of operations in June and July has persisted during the last two months of the year. The return of labor was curiously spotty and variable as between mining districts and regions and as between mines within districts. Generally speaking, the Southwest experienced a proportionately greater influx of mine labor than did Washington, Montana, Utah and Nevada. Even during the war Michigan escaped the severe manpower shortages suffered by the copper producers in other areas and 1946 was no exception. It is interesting to speculate on the influence the warmer and more pleasant climate of the Southwest has had on increased mine employment in this region.

On the assumption that the improved mine manpower situation will continue to a point approaching that of, say, 1943, it cannot be anticipated as a consequence that copper production will increase in direct ratio to the additional number of miners employed. In many underground operations increased manpower cannot be immediately translated into terms of increased copper output. The depletion of ore reserves and the lowering of grade due to the neglect of development and exploratory work during the wartime manpower stringency will mean that returning miners must be first utilized in this type of work. A lag of many months, and perhaps years, may be expected before copper output comparable to the year of 1943 will be forthcoming. The same situation is partially true with respect to the industry's open pit operations in which the years of labor shortages have led to a necessarily unbalanced stripping ratio which must be corrected before maximum output will be attained.

Copper Price Rise Follows Decontrol

In anticipation of the continuation of the OPA beyond June 30, legislation, the so-called McFarland bill, was introduced in Congress early in the year. This bill proposed to extend the Premium Price Plan to June 30, 1947, and incorporated certain provisions to increase the ceilings on copper, lead and zinc by an amount not less than 60 per cent of the then existing initial premium which in the case of copper was 5c. The new ceiling for copper would have thus become 15c. Part of the purpose of the bill was "in order to adjust such plan (Premium Price) to take into account the increasing proportion of civilian purchase and to reduce the cost to the Government." Hearings were held on this piece of legislation but a committee vote was never held since events removed the necessity for its further consideration. Taking cognizance of the increased mining costs of a large portion of domestic copper output and recognizing that custom smelters were suffering a squeeze between the fixed price and rising costs, the OPA, effective June 3, raised the copper price to 14⅜c from the long-standing level of 12c. By Government order sales at the new level were permitted copper producers only as a condition of the granting of the going 18½c per hour labor increase plus certain retroactive wage adjustments. To mines not operating under the Premium Price Plan the Government guaranteed the reimbursement of the amount of these back wage payments. For mine operators receiving subsidy payments the Government agreed to grant premium increases sufficient to indemnify them for retroactive wage costs, but compensatory premiums were granted only where an operator's "margin" was such that by Quota Committee standards the retroactive wage increases could not be absorbed. The ceiling increase to 14⅜c served to pass on to consumers a 2⅜c portion of the full 5c initial premium heretofore paid in full out of Federal funds. There is little need to comment upon what is now known as the OPA "holiday." The copper price remained at 14⅜c during this period. The Premium Price Plan was extended until June 30, 1947, under the same terms as in the past except that incorporated in the subsidy section of the bill extending the OPA was a provision that "adjustments shall be made to encourage exploration and development work and adequate allowances for depreciation and depletion." It further provided that all classes of premiums should be non-cancelable unless necessary in order to make individual adjustments of income to specific mines. On September 19 the Quota Committee issued a set of instructions outlining the procedure for making application for added development and exploration premium allowances in conformance with the provisions of the mine subsidy portion of the bill extending the OPA. On November 9 general decontrol of virtually the entire American economy, including the nonferrous metals, witnessed a rise in the price of copper to 17½c, the latter corresponding to a world price at the same level. With the abandonment of metal price ceilings, subsidies to mines needing financial assistance under the Premium Price Plan were to be calculated using average monthly market quotations as a base. Not altogether unexpected because of action taken 10 days previously on lead was the RFC announcement on November 19 that further foreign copper purchases would be discontinued except for outstanding commitments. Within four days thereafter the copper price rose to 19½c at which level it has remained up to the time of this writing.

A Minor Shortage in Scrap Copper Occurred in 1946

Throughout the year, scrap receipts at primary smelters and refineries for conversion to refined copper were at an extremely low level. According to Bureau of Mines figures which are incomplete in some respects, scrap

dealers' stocks remained at high levels relative to the war period. They were 70,600 tons on January 1. As a result of the first 2¾c increase in the electrolytic copper price on June 3, stocks were reduced from the 79,000-ton May level. Although actual figures are not available beyond October 31 when stocks were 67,000 tons, it is believed that they have again built up to an even higher level at the year's end. Characteristic of periods of virgin metal shortages, however, dealers' shipments during the year went largely to secondary smelters and ingot makers. Since dealers' receipts remained at a fairly constant level, the building up of dealers' stocks lead to a minor scrap shortage by these classes of consumers, and the balance of their needs was made up by the purchase of electrolytic and fire-refined copper. Because of the abnormal dealers' accumulations, this channeling of new copper to consumers capable of using scrap had the effect of tightening the refined copper supply. Sometime early in 1947 a number of factors will probably bring about an increase in dealers' shipments and a substantial reduction in dealers' inventories. While secondary smelters and ingot makers will no doubt take the greater proportion, primary smelters and refineries will receive a share and a further drain on refinery output, however small this may have been during the year, will be halted.

A Tight World Market in Copper

Foreign demand and production were subjects of particular importance and significance during the year. The situation was essentially one in which the British Ministry of Supply and the RFC vied with each other in the foreign purchase field. The competitive buying of these British and U. S. Government agencies was the major cause of the tight world market and rising world price. For the most part consuming nations other than Britain and ourselves played the role of beggars at the table, being obliged to content themselves with the small copper crumbs dropped from the table of the two principal banqueters. Commencing in April the foreign price was established at progressively higher levels. The average was 12.16c in that month, 15.41c in July and 17.62c in November. On the basis of singularly small tonnages of copper the foreign market generally was "thin" in the sense that any sizeable amount of copper made available through increased production or a decrease of demand could easily have halted this upward trend.

Statistics on production and consumption outside the U. S. are either unavailable, fragmentary or inaccurate. However, it is believed that in spite of production handicaps imposed by strikes, manpower shortage and lack of fuel, foreign output for 1946 will approximate 1,600,000 tons, including Russia and her satellite Balkan neighbors. During the year British stocks were not drawn down as were those of the RFC. While greater tonnages of copper might have been actually consumed had copper been obtainable, it may be assumed that world consumption and supply were out of balance at least by the extent of the lowering of the RFC stockpile since U. S. Government purchases must be included as a part of world demand. According to the Department of Commerce these duty-free imports totaled 169,387 tons during the first nine months of 1946. Although other factors played their part, indicative of the 1946 world supply-demand situation is the fact that for the same three quarters of 1945 the Government brought in 658,263 tons.

Outlook for 1947

Domestic Production — As previously mentioned, much depends upon the availability of labor at mines and mills. Mine production for each of the two months of October and November has been about 70,000 tons or at an annual rate of 840,000 tons. Assuming no labor stoppages and that the present labor return trend persists, a 1947 mine output of 900,000 tons should be approached. This latter production figure could actually be exceeded if labor returns at a sufficiently rapid rate to justify management placing a substantial portion of the additional manpower on production while at the same time catching up on development and exploration. A favorable price situation will certainly weigh in favor of all-out production. To the 900,000 tons of mine output can be added 25,000 to 50,000 tons of refined copper from secondary materials. Because of large tonnages of foreign returnable copper in scrap, capacity limitations may preclude our domestic smelters and refineries from approximating 50,000 tons of refined copper from scrap for U. S. consumption. Let us put 925,000 tons down for the total 1947 U. S. refinery output from domestic sources.

Domestic Consumption—While domestic deliveries during the first few months of 1947 may hold up at the high rate prevailing during the last three months of 1946, it is believed that consumption will follow a downward curve thereafter for the balance of the year. Consumption may average out at about 1,250,000 tons for the year 1947.

Foreign Copper in '47—Its Relation to U. S. Situation

Although the above figures for domestic consumption and demand are certainly no more than guesses, there appears to be no question of the need for some 300,000 to 375,000 tons of imports during 1947. As an importing nation we will be dependent upon the world market irrespective of what action may be taken with regard to the copper tariff. Therefore, the foreign and domestic copper situations during 1947 will be closely interrelated and the effect on us of production and consumption abroad will be pronounced.

A foreign production figure of 1,600,000 tons has been estimated for 1946. Given a satisfactory price level and assuming that labor troubles and other hindrances such as lack of fuel will be gradually overcome, output for 1947 should exceed the 1946 figure. On the demand side, there is some evidence that certain foreign consuming nations may have overpurchased, and that substantial tonnages taken in 1946 will not be bought in 1947. While the over-all world need for copper may not have lessened, a realization that its consumption in terms of fabrication and actual use must be spread over several years may cause certain nations to slow down their timing of purchases. In other words, an abatement of the "must have copper now" psychology may well take place during 1947. Lack of credit may also affect some nations' buying programs. These considerations, including our own probable diminishing need for imports, when combined with anticipated improvement in world supply, may well result in a balance being achieved sometime during the year.

Until the stringent world copper situation alters as indicated, the RFC being out of the allocation picture after March 30, the domestic economy will probably be short of copper, for even if a downward adjustment of the tariff is made, such action will not necessarily make additional foreign copper available or facilitate its flow to this country. Be that as it may, tariff revision or suspension will serve to modify the domestic price to the world level plus approximately the amount of the duty as reduced, or in the event the tariff is suspended, the domestic price will about equal the foreign market level.

In 1947 the dominant note will be that of striving for greater production to balance supply and demand. Price, both domestic and foreign, should be satisfactory in relation to past experience, taking the rising costs of production of the past few years into consideration. Copper can anticipate a year of full production and a ready market.

Many iron mining companies are investigating conveyor system for pit operation

IRON ORE and Beneficiation

★

By GROVER J. HOLT
Chief Engineer
Cleveland Cliffs Iron Co.

★

PRELIMINARY figures indicate that the total iron ore shipped from all mines in the United States in 1946, totalled 71,700,000 gross tons. This drop of 17 million tons from the 89 million ton shipment in 1945 was due in part to the turbulent labor situation throughout the country, but principally to the strike of iron miners in the Lake Superior District during the early months of the year. The autumn strike in the coal fields affected the lake shipments but little since the season was practically over before it was called. A strike of the Lake Superior Maritime union, however, did affect the totals. Favorable weather on the lakes, allowing traffic into early December, aided shipments substantially.

The Lake Superior District shipped a total of 59.7 million tons, the Southern Districts 7.5 million tons, the Eastern District 2.3 million tons and the Western Districts 2.2 million tons.

A tabulation of total U. S. shipments by Districts, from 1942 to 1946, inclusive, as well as a breakdown of shipments by Ranges from the Lake Superior District from 1942 to 1946, inclusive, is shown in Table I.

The impact of the strike situation throughout the iron and steel, electrical and general manufacturing industries, has had a crippling effect on iron ore mining in slowing down deliveries of much needed new equipment to replace the wear and tear of wartime over production. With a view towards heavy peacetime production, the industry is entering into a long range planning campaign for the future and new equipment is badly needed.

Lake Superior District

The heavy war demands for iron resulted in severe depletion of open pit ores of both direct-shipping and straight wash ore types. The former are shipped without concentration and the latter constitute the best and most easily concentrated wash ores. Emergency production was necessarily made up, to a large degree, from these ores. The sinking of shafts and development of underground mines, as well as the construction of plants to treat low-grade wash or jig ores and iron formation, requires years of work before production is possible. This was demonstrated in other mining districts where the attempt was made to augment wartime requirements.

Just what these inroads into open pit reserves mean, can best be visualized by comparing actual production increases during the war period from the Lake Superior District (United States) open pits with the production from underground mines of the same District as shown in Table III.

During the 1936 to 1940 period, the production of washed concentrates varied from 19 per cent to 23 per cent of the total open pit ores shipped,

TABLE I

U. S. ORE* SHIPMENTS BY PRODUCING DISTRICTS (a)

District	1942 Gross tons	1942 % of total	1943 Gross tons	1943 % of total	1944 Gross tons	1944 % of total	1945 Gross tons	1945 % of total	1946† Gross tons	1946† % of total
Lake Superior: Minn., Mich., Wis....	93.01	87.10	85.98	85.85	81.86	85.52	75.96	85.35	59.7	83.3
Southern: Ala., Ga., Va., Tex., Mo.....	9.21	8.63	8.53	8.52	7.40	7.73	6.66	7.48	7.5	10.5
Eastern: N. Y., Pa., N. J.....	3.08	2.88	3.19	3.18	3.50	3.66	3.62	4.07	2.3	3.2
Western: Wyo., Utah, Calif., N. Mex., Ariz., Nev., Wash.	1.48	1.39	2.45	2.45	2.96	3.09	2.76	3.10	2.2	3.0
Total.....	106.78	100.00	100.15	100.00	95.72	100.00	89.00	100.00	71.7	100.00

* Exclusive of by-product pyrite cinder and sinter from various sources.
† Estimated on December 10.
(a) Sources: U. S. Bureau of Mines, Lake Superior Iron Ore Association, and others.

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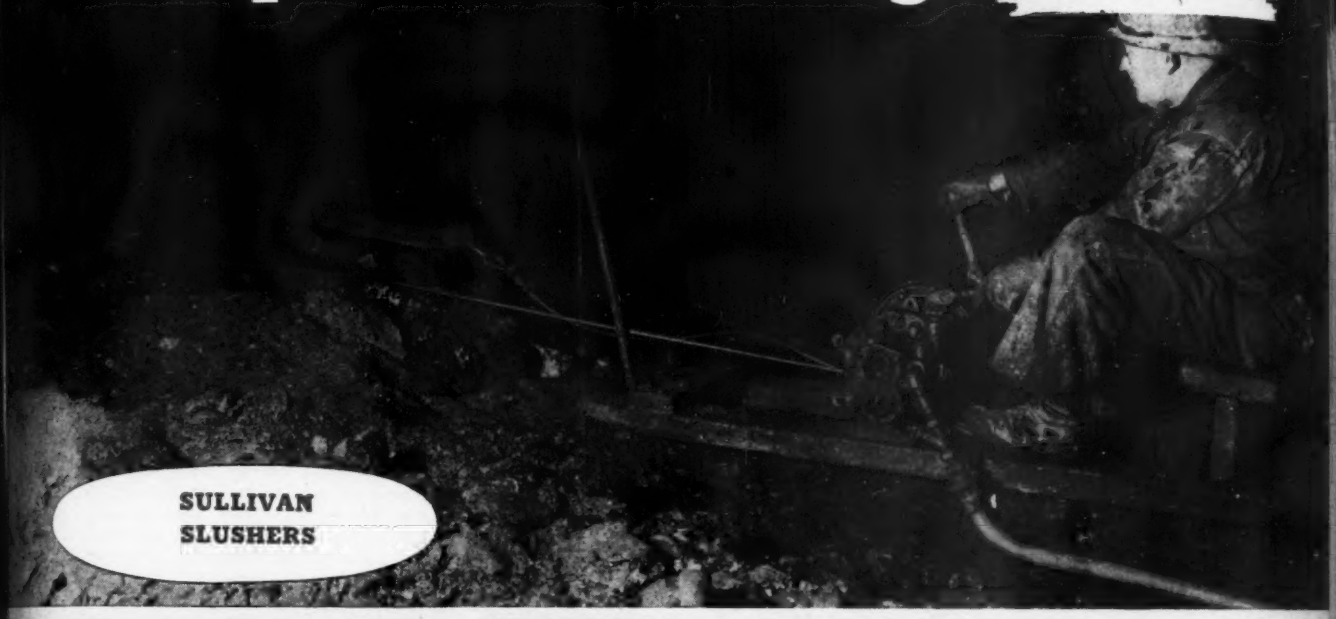

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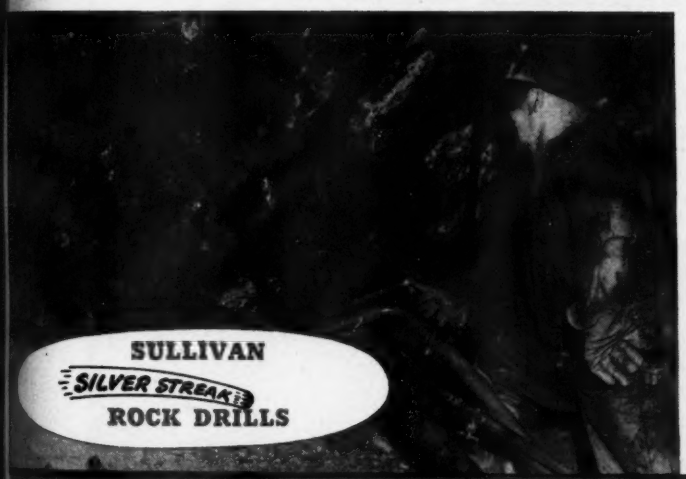

SULLIVAN SILVER STREAK ROCK DRILLS

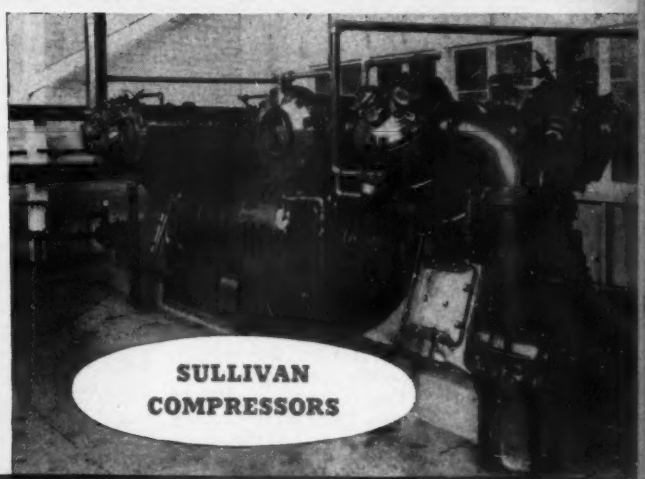

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TABLE II

MINE SHIPMENTS OF LAKE SUPERIOR IRON ORES DURING LAST FIVE YEARS TO LAKE PORTS AND ALL-RAIL—IN GROSS TONS

	1942	1943	1944	1945	1946 †	Percent of Total, 1946
U. S. Ranges:						
Mesaba	70,280,087	64,906,280	62,509,212	58,368,594	46,073,000	75.52
Vermillion	1,924,877	1,779,014	1,538,560	1,446,079	1,374,000	2.25
Cuyuna	3,035,532	3,065,555	2,538,492	3,015,899	2,623,000	4.30
Total Minnesota	75,299,667*	69,971,276*	66,586,264	62,830,572	50,070,000	82.07
Gogebic	6,237,894	5,486,918	5,604,354	4,304,317	3,713,000	6.09
Marquette	6,540,731	5,601,418	4,790,177	4,585,436	3,341,000	5.48
Menominee	4,930,434	4,902,556	4,876,210	4,240,546	2,548,000	4.17
Total Mich.-Wis.	17,709,059	15,990,892	15,270,741	13,130,299	9,602,000	15.74
Total U. S. Ranges	93,008,726	85,962,168	81,857,005	75,960,871	59,672,000	97.81
Canadian Ranges:						
Michipicoten	486,666	450,973	482,083	513,804	509,000	0.84
Steep Rock	.....	.....	16,552	505,375	826,000	1.35
Total Canadian	486,666	450,973	498,635	1,019,179	1,335,000	2.19
Total Lake Superior	93,495,392	86,413,141	82,355,640	76,980,050	61,007,000	100.00

* Includes some ore from southeast Minnesota also.
† Subject to correction when final figures are available.

TABLE III

Period	Lake Superior (U. S.) District open-pit ores, direct and concentrates: Millions of tons shipped	% of total shipments	Lake Superior (U. S.) District, undergr'd ores: Millions of tons shipped	% of total shipments	Lake Superior (U. S.) District total shipments, Millions of tons shipped
1936 to 1940, incl.	164.9	69.4	72.5	30.6	237.4
1941 to 1945, incl.	322.7	77.3	94.8	22.7	417.5
	Open-pit ores		Underground ores		Total district
Percentage increase in shipments: 1941 to 1945, incl., 1936–1940, incl.	95.7%		30.7%		75.9%

while from 1941 to 1945, inclusive, this production varied from 22 per cent to 25 per cent, showing that the production of concentrated ore held its own with the direct ore open pit production during the war period. This was not done by building new plants, but by pushing the capacity of existing plants beyond the economic limit. Underground mines were not able to equal this record.

The inability of underground mines to increase tonnage at a rate comparable to direct-shipping open pit operations, is a problem for serious consideration in the event of a future emergency. The reserves of direct-shipping ore have been depleted at a higher rate than those of the more expensive underground ores and concentrated open pit ores. When large direct-shipping open pits are exhausted, production must come from underground mines and smaller and deeper open pits—properties containing ores requiring more difficult concentration processes. Large scale development programs will be necessary to replace the productive capacities of some of the larger pits which have produced from 5,000,000 to 20,000,000 tons annually during peak production.

Careful consideration should be given to the price and tax structure for iron ore properties. The low price obtained by the producer coupled with the slight margin of profit during the past several years, has not been sufficient to provide funds for opening up new low grade ore pits, building concentrating plants to treat low grade iron ores and iron formations, and for sinking shafts and developing underground properties.

The price for a Mesaba Range non-Bessemer ore containing 51.50 natural iron, whether mined and shipped in the crude state or concentrated, was about $3.04 f.o.b. mine in 1939 compared with an f.o.b. mine price of $2.94 in 1946, a decrease of 10 cents per ton. The price f.o.b. mine in 1939 for a base non-Bessemer ore of 51.50 natural iron produced from underground mines on the Gogebic Range was $3.22 compared with $3.22 in 1946, showing no increase. The Marquette Range base non-Bessemer ore price in 1939 was $3.54 f.o.b. mine compared to $3.56 f.o.b. mine in 1946, or an increase of 2 cents per ton.

In computing the above base prices the published Lower Lake values have been used and the usual deductions have been made for rail and lake freight, transportation tax when effective, and the standard allowance for shrinkage, analyses, etc.

From the above it will be seen the Mesaba Range f.o.b. mine price has been decreased since 1939 approximately 3 per cent. In the case of the Gogebic Range there has been no change and in the case of the Marquette Range there has been an increase of approximately .6 per cent. In the same period, however, common labor rates have increased approximately 54 per cent. Open pit ores requiring concentration must carry from three to four times the labor costs necessary to produce direct-shipping ores; underground ores require from six to seven times the expenditure for labor required in producing direct-shipping ore. As result there is little incentive and little or

Open pits have an important advantage—emergency demands can be met at short notice

no profit margin provided to develop either low grade ore bearing materials which must be mined by open pit, or high grade underground properties to maintain future production. The desirability of promoting development and production of iron ore concentration methods and underground mining to secure adequate domestic ore supply for the future seems clearly indicated, but the problems of increasing costs and decreasing profit margins must first be solved. Surely this deserves the most careful consideration on the part of producers, consumers, taxing authorities and all others connected with the mining of iron ore, as well as the steel industry as a whole.

Mesaba Range

Open Pit Mining:

The year of 1946 finds the open pit operators extending mechanization efforts in the struggle to bring production costs down to combat increased cost of labor and supplies. Loading equipment for stripping and ore has been changed, but little. Large draglines are under consideration in connection with stripping operations. In the transportation of stripping to the dump site, trucks have largely replaced locomotives and cars in all but the larger open pits. Twenty and 25-ton pay-load trucks are replacing the 15-ton pay-load units.

For the transportation of stripping at the South Agnew Mine, now under development, Butler Brothers are clearing ground for a conveyor belt operation. Other companies are also investigating this field of transportation in attempting to remove deep stripping.

Practically all of the open pit ore mined must be drilled and blasted prior to loading, and larger and heavier churn drills are being purchased especially for rock work. Two new methods of drilling have been tested in 1946 on the Mesaba Range. The Linde Air Products Company have developed a method of fusion piercing for putting down blast holes in hard taconite ore formation. In this method, oxygen, fuel oil, and flux are delivered through a blow-pipe and the ore material fused or spalled. The fused and spalled material is blown from the hole by high pressure steam generated by water which cools the blowpipe and turns to steam on passing into the heating zone. It is stated that heat stresses set up in the rock provide multiple fractures. This results in much better fragmentation on blasting, which should reduce crushing costs.

A small hand piercing tool for smaller holes has also been developed for use in block-holing. With this new method, holes may be drilled vertically, horizontally, or at any angle. These tests were conducted on the magnetic taconite ores of the Reserve Mining Company at Babbitt, Minn.

The Ingersoll-Rand Co. has developed and tested on various Mesaba properties an air-operated piston type of large diameter drill. Both of these new drills are a radical departure from conventional churn drill and are said to increase drilling speed substantially.

In the few large open pits where steam haulage was formerly used, Diesel, Diesel electric, and electric locomotives are replacing steam units.

The general trend in ore conveying systems is toward longer belt flites and several long haul steel cord and cotton cord belts have been used during the year. The longest steel cord installation in a single flite of 1,106 feet with a lift of 500 feet, is in use at the Gross-Marble Mine of the Oliver Iron Mining Company near Marble, Minn. The longest cotton cord type of belt in a single flite of 946 feet, with a lift of 550 feet, is in use at the Missabe Mountain Mine of the Charleston Mining Company. This lengthening of conveyor flites eliminates transfer points which are the source of belt wear, maintenance, and supervision.

Conveyor belt speed has been increased on the Ranges from the former practice of running belts 350 to 400 ft. per minute up to speeds from 500 to 580 ft. per minute, thus allowing the use of narrower belts for a given load.

Conveyor belt transportation of ore from the pit bottom to surface is rapidly replacing all other methods of haulage. The Mesaba-Cliffs Mining Company is now dismantling its Holman Mine washing plant, which will be modernized and reerected on the edge of the open pit at Taconite, Minn. A screening and crushing plant will be located in the pit for truck delivery, and two 900 foot long cotton cord conveyor flites, each with a lift of 200 feet, will be installed to transport the ore to the washing plant. At the transfer point, between these two conveyors, a surge bin will be installed. Tailings will be returned to the old tailings basin by means of pumps and a pipe line, 7,500 feet long.

Stripping operations were started late in the year at the Atkins Mine by The Cleveland-Cliffs Iron Company in preparation for production in 1947. The operation of this mine is being carried on by The Cleveland-Cliffs Iron Company with the Inland Steel Company. A crushing and screening plant, and a belt conveyor system will be installed for delivery of ore to a railroad loading bin on surface.

The Mary Ellen open pit at Biwabik is being reopened by the Stanley Mining Company. The production will be washed.

No new large open pits have entered the shipping list in 1946; however, two smaller pits have been brought into production, namely the Vivian, by the North Range Mining Company and the Graham by Zontelli Bros. Both of these properties are near Mesaba on the Eastern end of the Mesaba Range.

Beneficiation

Iron ore beneficiation, especially concentration, was the subject of much attention in 1946. Operating companies now maintaining ore testing and research laboratories, are Butler Brothers, Pickands, Mather & Company, Mesaba-Cliffs Mining Company and the Oliver Iron Mining Company. Open pit concentrating ores are tested to keep plant practice abreast of production. The Mines Experimental Station of the University of Minnesota has been devoting much effort to the working details of fine ore agglomeration and is making a detailed study of concentration processes in general. Battelle Institute is continuing its study on the concentration of taconite.

The greater portion of the concentrates produced come from the treatment of the better grade wash ores. The plant flow sheet involves the principle of sizing in which fine sand is washed out of coarser concentrates by hydraulic means involving screens, log washers, and classifiers. This type of concentration is locally called "straight wash."

Usually, as wash ore deposits are exhausted, the ore below and on the fringes, is found to contain rock in all particle sizes and "straight washing" is followed by ferrosilicon sink-float or jigging to eliminate this waste. Where sink-float is used, the ore is sized from 1¼ in. to $\frac{3}{16}$ in., and the fines treated by hydraulic equipment. Jigging is commonly done without sizing.

Sink-float is extremely efficient on the coarse sizes, but in the treatment of the finer fractions much is to be desired due to mechanical entrainment of waste in the concentrate. Jigging is subject to the same difficulty. Abrasion grinding by subjecting the ore to a grind in ball or rod mills appears promising. The method uses light ball or rod charges to reduce the silica size to that which will overflow a classifier. Classifier overflows, usually minus 65 or 100 mesh, are being treated in hydrosizers and hydrotators for the recovery of additional fine concentrates.

Only one ore drying plant is in operation on the Mesaba Range at the Weggum Mine of Butler Brothers.

At Aurora, the State of Minnesota has started construction of a plant to produce powdered iron from iron carbonate formations. Construction was temporarily halted during the winter, due to lack of equipment deliveries.

Underground Mining

Underground mining on the Mesaba Range was not expanded greatly in 1946. The Fraser underground operation is being brought into production by the Oliver Iron Mining Company, as the only addition to the production list.

The Bennett underground mine of Pickands, Mather & Company has for some time been successfully utilizing shaker conveyors and belt conveyors for ore transportation.

Vermilion Range:

No new properties have been opened on the Vermilion Range and four underground mines made up the entire production. The use of diamond drilling for blast hole work is being used in the hard ore properties. The Vermilion is the only Range in Minnesota producing lump ore for open hearth use.

Cuyuna Range:

The Cuyuna Range has seen no new mines enter the production list in 1946. Only one underground mine remains in production.

Pickands, Mather & Company have drained a portion of Rabbit Lake preparatory to opening the Kennedy Mine as an open pit. This company has also operated its drying plant at the Sagamore Mine at Riverton.

The M. A. Hanna Company have taken over the operations of the Evergreen Mines Company and have installed a long-haul conveyor from the bottom of the Portsmouth open pit to the washing and sintering plants. This is the only sintering plant located at any mine on the American side in the Lake Superior District.

Gogebic Range

Underground mines have accounted for all of the 1946 production, with the exception of ore from the Plymouth open pit. No new orebodies have been reported and no new mines opened. Pickands-Mather have completed sinking the New Cary shaft by means of stripping down a calyx drill hole and transportation of rock underground. A thoroughly new and modern surface plant, involving crushing, screening, and conveying of ore to the railroad car loading bin, is ready for operation in 1947.

Menominee Range

The Menominee Range had 13 underground mines producing direct ore and two siliceous ore open pits in operation in 1946. The Sherwood underground mine, operated by the Inland Steel Company, has completed a new belt conveyor installation for transportation of ore from the working cross-cuts to the shaft pocket. Shaking conveyors, operating in the cross-cuts, convey the ore from the stope chutes to feed the belt conveyor.

The Hanna Iron Ore Company is utilizing churn drill holes from surface to deliver stope filling into the working areas underground. They are also installing larger hoists and scrapers and utilizing more mucking machines than heretofore. At one of their properties, the crusher has been removed from the headframe and placed in an underground station.

The only concentrating plant on the Menominee Range is at the Book Mine operated by the North Range Mining Company at Alpha, Michigan, treating a lean ore stockpile from a former open-pit operation.

The auxiliary ore docks partially erected at Escanaba by the Federal Government during the war have been dismantled and removed.

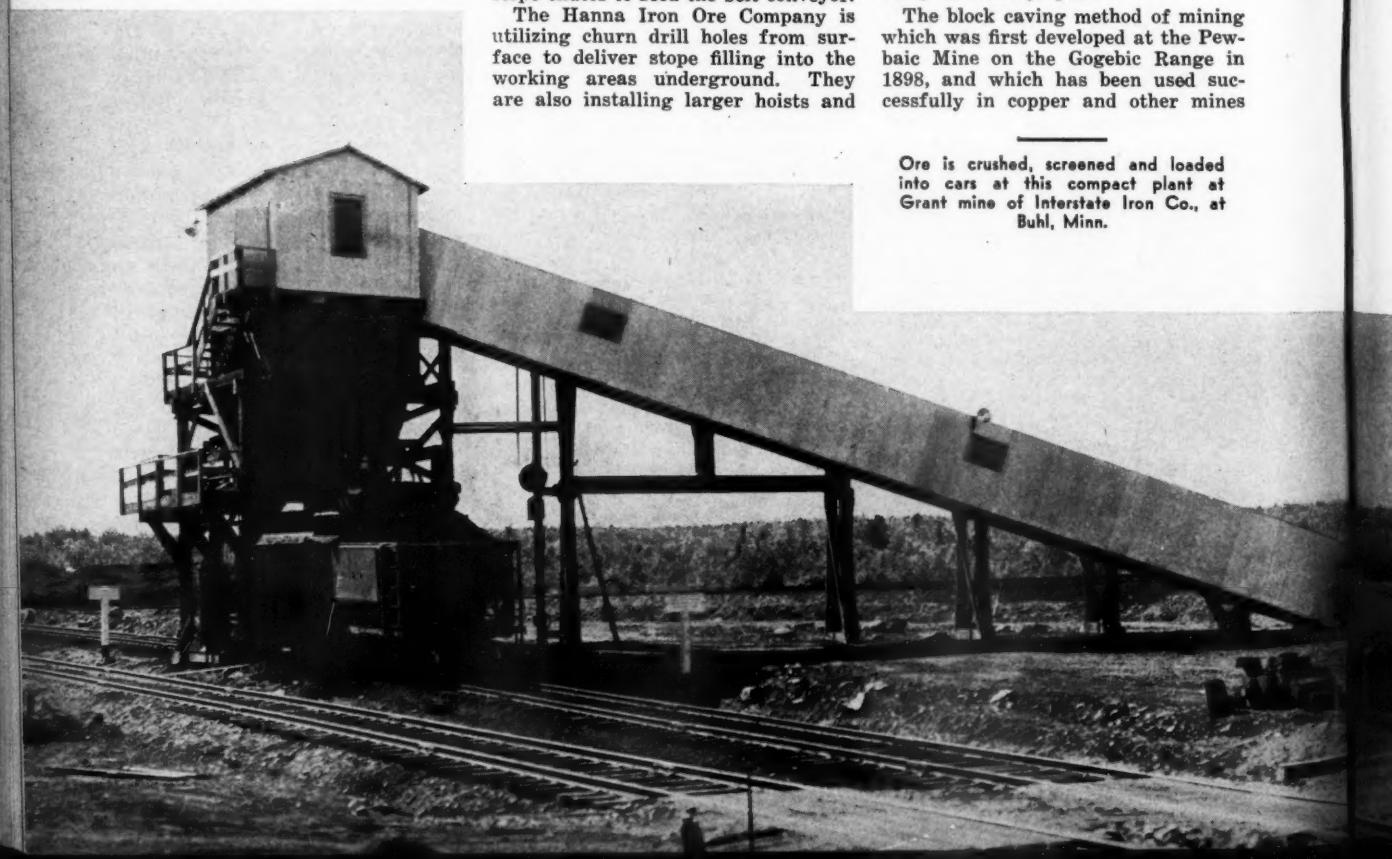
Marquette Range

The entire output of high-grade blast furnace ore from the Marquette Range was produced from 10 underground mines. Three siliceous ore open pits were in operation. The Cliffs Shaft and Greenwood Mines produced the only lump ore for open hearth use from the district. No new mines were opened in 1946.

The Marquette Range has seen a continuation of the most active drilling campaign of any of the Lake Superior Districts in 1946. The Cleveland-Cliffs Iron Company and Jones & Laughlin are carrying on active exploration programs.

Marquette Range jaspers (iron formation) are receiving a great deal of attention by both the Jones & Laughlin Company and The Cleveland-Cliffs Iron Company. Jones & Laughlin are erecting a new modern laboratory for conducting research work and The Cleveland-Cliffs Iron Company are conducting tests on the concentratability of these jaspers.

The block caving method of mining which was first developed at the Pewbaic Mine on the Gogebic Range in 1898, and which has been used successfully in copper and other mines



Ore is crushed, screened and loaded into cars at this compact plant at Grant mine of Interstate Iron Co., at Buhl, Minn.

in the United States and Canada, is being tried on the Marquette Range by The Cleveland-Cliffs Iron Company. Stoping and caving methods are being used wherever possible on the Marquette Range, thus reducing the extent of top slicing operations.

The Princeton Mine was abandoned by The Cleveland-Cliffs Iron Company in 1946.

Eastern Districts

New York

New York State leads the eastern group in point of production. All of the 1946 ore was subjected to magnetic separation processes with the exception of hand-sorted lump. Open stope and sublevel stoping methods, utilizing ring drilling, are used underground.

Jones & Laughlin purchased the Benson plant from the Defense Plant Corporation during the year and will operate the mine on open-pit ore, later to be followed by underground mining.

At the Clifton Mine of the Hanna Coal and Ore Corporation, diamond drilling of blast holes has been adopted.

Republic Steel Corporation operates the Chateaugay, Fisher Hill, Harmony, and Old Bed properties.

New Jersey

The main production of New Jersey mines comes from underground shrinkage stoping and a minor portion from sub-level stoping operations. The ore is treated by magnetic concentration, and sintering.

The Alan Wood Steel Company are testing the use of diamond drilling for blast holes at the present time.

At the Mt. Hope Mine, Warren Pipe & Foundry Company are separating lump ore magnetically, using a final hand-sorting operation. Blast furnace ore is also concentrated by magnetic separation.

Pennsylvania

The Cornwall operation of the Bethlehem Steel Corporation furnishes the state's output from open-pit and underground operations. The only reported use of block caving in the eastern magnetic field, is at the Cornwall property. Block caving practice is similar to the methods used at the Climax Molybdenum property in Colorado.

"... There is little incentive and little or no profit margin provided to develop either low grade ore bearing materials which must be mined by open pit, or high grade underground properties to maintain future production."

Southern Districts

Alabama

Ten properties are reported on the active list in 1946, with the bulk of the production from seven underground operations utilizing stoping and room and pillar methods of mining. Four mines are producing by open-pit methods, all of this ore being washed by log washers. One washing plant contains a table installation.

Missouri

The largest producer in the state is the Iron Mountain Mine of the Ozark Ore Company, who are producing concentrates by jigging. A few scattered smaller operations have also been active.

Texas

The only operation in Texas has been the production of washed concentrates from the properties operated during the war by the Sheffield Steel Corporation. The properties and washing plant were leased by Peter M. Chamberlain.

The Lone Star Steel Company's plant and mining properties were inactive during the year.

Western District

Wyoming

Colorado Fuel and Iron Company are producing about 94 per cent of the tonnage from block caving and the balance from sub-level stoping underground at their Sunrise Mine. The new shaft, crushing, screening and lump sorting plant is in full operation.

Utah

Three open pits have accounted for the Utah 1946 production. These are the Duncan of Colorado Fuel & Iron Company, the Columbia of Geneva Steel Company and the Lindsay Hill of the Kaiser Steel Company.

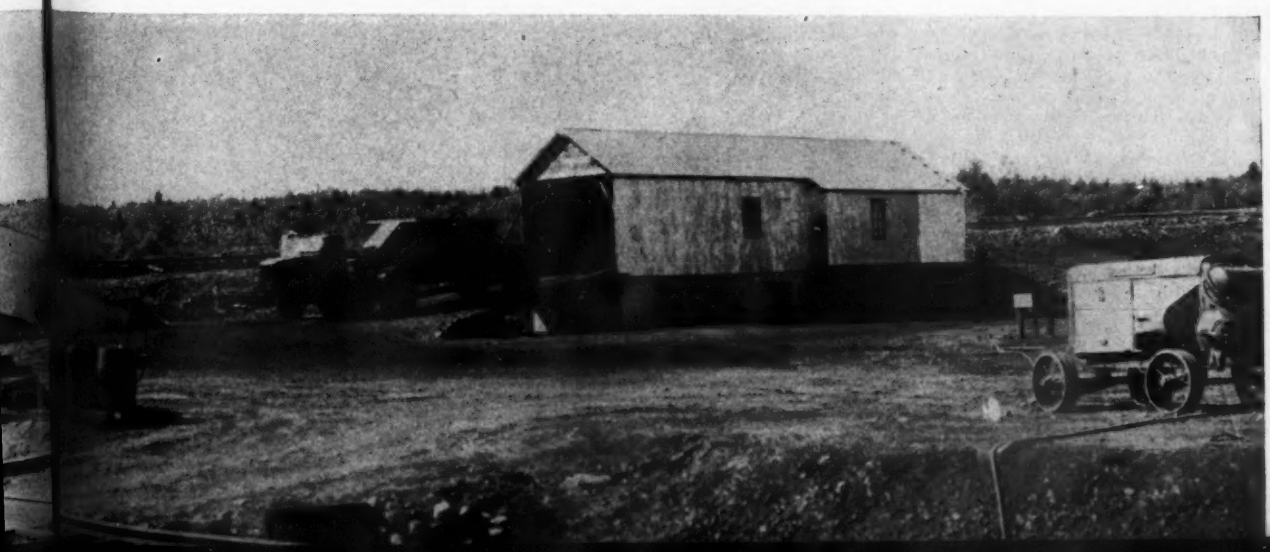
California

The only production from the state came from the Vulcan open pit of the Kaiser Steel Company.

Canadian Districts

Steep Rock Iron Mines, Ltd., have brought their "B" orebody open pit into substantial production during the 1946 season. Electric shovels are used in loading and trucks are being used to haul the ore from the pit to the crushing plant on the surface

(*Continued on page* 91)



The Lead Market in '46

By IRWIN H. CORNELL
Vice President and Sales Manager
St. Joseph Lead Co.

THE year just over, was an eventful one in the lead industry. For almost four and one-half years the official lead price had been held by the Office of Price Administration at 6.5c a pound, f.o.b. New York basis. There has been no time in history when the United States market price of this metal has been unchanged for such a long period.

During the early years of World War II, the lead supply seemed adequate for all war purposes, in fact, a definite effort was made to substitute lead for zinc that was so badly needed in the production of ammunition. Heavy subsidies were paid to zinc mines and lead production was not stimulated in this way at first. In fact, the Government stocks of pig lead in 1943 exceeded one-quarter of a million tons and not until December, 1944, did these stocks drop below 100,000 tons. At the end of 1946, these same stocks were estimated at approximately 35,000 tons, or about two weeks' supply.

Holding the 6.5c price ceiling from January, 1942, to June, 1946, did not mean that the mines were paid on this basis. Nearly all the lead mines of the country received some bonus, although there were several fair-sized mines that did not receive any price premium, the average price received by the mines was estimated at 10.3c during the second quarter of 1946. What it did mean, however, was that all consumers during this period could buy lead at 6.5c, thus a heavy subsidy was placed on the consumption of lead. This tended to vastly increase the use of lead at a time when it was becoming scarce all over the world, and the foreign price was steadily advancing.

Peace-time Demands for Lead Were Difficult to Meet

Reconversion was largely responsible for the increased demand. Lead in peacetime is in much greater demand than during a modern war. Largely due to a lack of manpower, domestic production, though heavily subsidized, fell during 1944, 1945 and 1946. The Government imports of pig lead dropped from approximately 366,000 tons in 1942, and 227,000 tons in 1945 to about 100,000 tons in 1946. Labor difficulties closed important mines and smelters in the early months of the year. It became obvious by the spring of 1946 that the United States price could not remain below the foreign price much longer and scrap shipments began to slow down, reducing one of the greatest sources of lead in the country.

Very early in 1946, the Government was urged by the lead industry to advance the ceiling price so that when control was abolished, the market would not explode and upset the industry with high prices that could not last. The OPA was adamant until June 4 when the ceiling price was officially advanced by 1¾c per pound to 8¼c, New York basis, a figure still below the foreign market and much less than the average price paid to the subsidized mines.

On July 1, the OPA holiday comcenced and the price moved up at once to 9½c. Lead ores and concentrates and lead scrap of all kinds poured into the smelters and it looked as if the shortage would be greatly relieved under the free market. This happy situation changed abruptly when the OPA again took control in August, and the price was rolled back to 8¼c. Shortly after this, scrap shipments diminished and in some districts dropped off to a trickle. Lead ores and concentrates bought on the 9½c market were frozen by the smelters and remained untreated in the bins.

Situation Became Acute During Autumn Months

From August 1 to November 11 the situation became steadily worse. Great consuming and fabricating companies of national standing shut down part of every month. Shortages of finished products appeared all over the country and the industry's efforts to produce for peacetime requirements were nullified by the attitude of the Government and the OPA.

A great effort was made by industry to design away from lead, but this, in most cases, is a long-time job. The lead-producing and consuming industries used every effort to bring about relief by urging the Government to free the market from control or at least to raise the price to equal the foreign market. In every case the OPA's answer was "No."

Conditions became worse each week; secondary lead sold in the black market as high as two cents over the ceiling price for primary lead. High-cost finished lead products were bought from time to time and remelted into ingots for caulking purposes. Lead scrap was sold at the official ceiling in conjunction with scrap of uncontrolled metals sold at high premiums over their market value.

The Lead Market Presented a Most Confused Picture in 1946. Removal of Price Controls and Government Restrictions Has Not Yet Reduced the Lead Shortage. The Use of Substitutes Can Aid Materially in Easing the Situation and Domestic Production Should Increase in the Months Ahead

The Laws of Supply and Demand Begin to Function

We do not believe that any such demoralized condition had ever been seen in the lead market before and we hope it will never be seen in this country again. When decontrol came on November 11, the domestic price immediately rose to the level of the price Metals Reserve Corporation was paying f.o.b. New York for foreign lead with no duty added, namely 10½c a pound. This figure was considerably lower than the prices quoted in continental Europe. While the new price stimulated the flow of scrap for the time being, and also brought about an increase in the working week from five to six days in the Rocky Mountain area, it soon became evident that American consumers could no longer obtain foreign lead unless they paid the foreign price at gulf ports plus transportation costs and duty, as the RFC would no longer buy foreign lead and absorb the duty. This brought about a second advance to 11.80 f.o.b. New York, that went into effect November 18. In December the foreign price went up to 11c gulf ports. To meet this foreign competition the price was raised a third time on December 16 to 12.55.

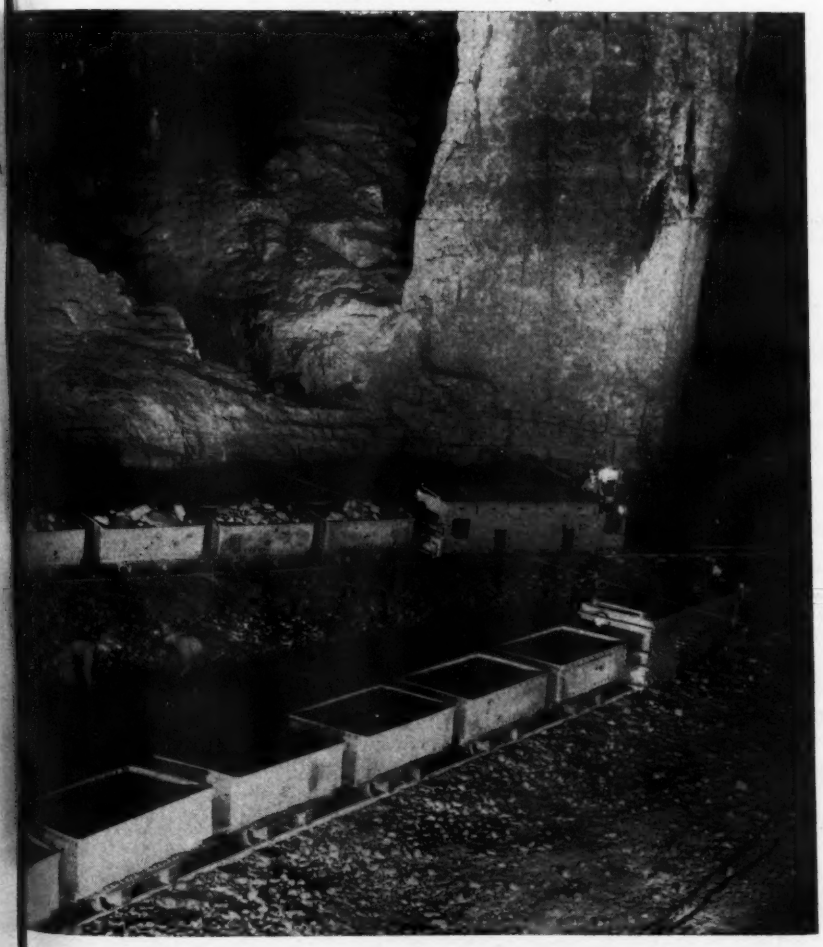
At the end of the year the price closed at 12.55, almost double the four and one-half years OPA ceiling and we believe the highest price on record. The market had practically "exploded" as the industry predicted it would if the pressure became too great before the metal was decontrolled.

By January 1, 1947, scrap was again coming into the market in quantity. The Rocky Mountain mines were estimated to have increased their production about 20 per cent and sales of foreign lead were apparently on the increase. The American lead industry will have a great problem on its hands in 1947. We believe it does not want to see higher prices, but the producers, to accept the challenge and win out must have the cooperation of the Government and the consumers.

The CPA has helped the situation as it became serious in 1946 by allocating lead from the Government stockpile. Any change in this policy at this time would seriously complicate the situation. But, we feel that the Government realizes this as well as the industry does and therefore will not choose the opening months of 1947 as the propitious time to take lead from current receipts and add it to the stockpile.

The fabricators and consumers have been held to very low inventories, in fact, about 70,000 tons of lead have been squeezed out of manufacturers' stocks during the year just passed. It is realized that operations of consumers were rendered most difficult when manufacturing plants have inventories varying from zero to a couple of weeks' supply. However, this pipeline just cannot be filled at this time.

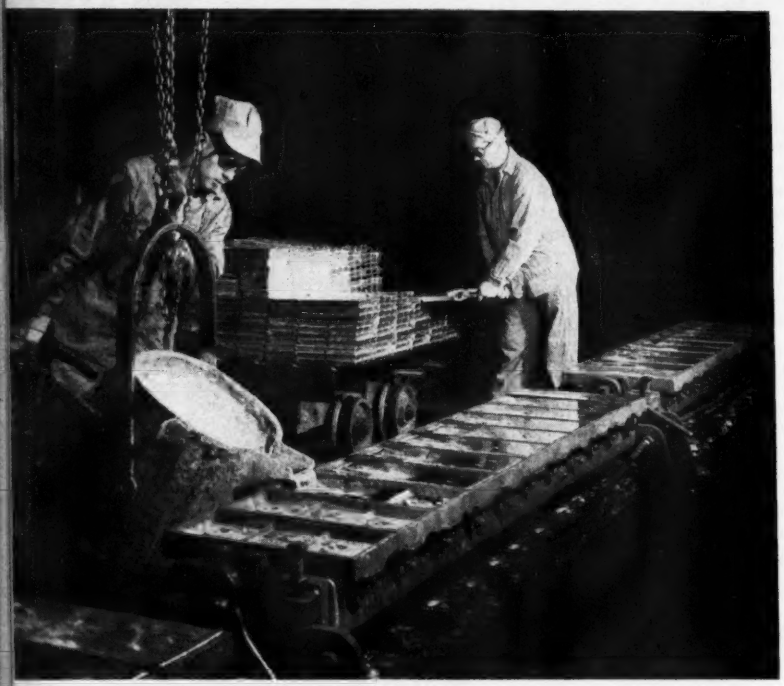
"Keep them rolling,"—a loaded train passes incoming empties underground in the Lead Belt of Southeast Missouri



Increased Production Anticipated for 1947

With the cancelation of the "M 38" order, there are no longer any Government restrictions on the amount of lead any industry can consume. Until consumption is screened and reduced through the economic effect of price it will be impossible to supply any of the various industries with the amount of lead they used to purchase, much less provide the tonnage to increase manufacturing programs. Certain industries that can use substitutes should give up lead. Industries making non-essential products that were previously barred by the CPA should not try to return to lead as their raw material.

During the difficult year we have just passed through, the consuming industries have worked in harmony with the producers; have backed the producers in asking for decontrol; have submitted to inadequate inventories with very good grace. While individually they have put a lot of pressure on the producers and selling agencies, they have realized the difficulties of increasing the available supply of lead and have been very patient. We bespeak their further forbearance. The producers have every reason to supply the quantity of lead needed for essential civilian requirements and within a few months we believe that the domestic mine production will be increased; smelted and refined, the vast accumulation of scrap in the United States will be collected and smelted, and imports of foreign pig lead will have increased.



ZINC

By RUSSELL B. PAUL
Resident Mining Engineer
The New Jersey Zinc Co.

The Outlook for Zinc Is by No Means Unfavorable. Despite High Costs and Labor Difficulties, Production in 1946 Compared Favorably with 1945 and Increased Demand Is Anticipated for 1947

CONSIDERING the numerous adverse conditions under which the zinc industry operated in 1946, its accomplishments were indeed quite remarkable.

After having produced over three and one-half million tons of recoverable zinc in ore from our domestic mines during the war year 1941-45 by concentrating efforts on ore production and deferring development work, we hoped to have an opportunity to operate our mines and smelters peacefully and profitably, to produce the required tonnage of zinc and to undertake the development and maintenance work postponed during the war.

Unfortunately, those hopes were not realized. The industry was plagued by strikes throughout the year. It was handicapped by lack of manpower and low labor efficiency with labor rates the highest in the industry's history; by high costs; by shortage of supplies and material; and by Government price controls.

Ore Production

Notwithstanding these troubles and difficulties, our domestic production of recoverable zinc in ore in 1946, November and December estimated, compared favorably with 1945 production and was as listed below. However, it should not be overlooked that to obtain the 1946 ore production it has been necessary, due to manpower shortage, to continue the deferment of development and maintenance work.

U. S. MINE PRODUCTION OF RECOVERABLE ZINC IN ORE, SHORT TONS.

1945—U. S. Bureau of Mines data.
1946—January-October—U. S. Bureau of Mines data.

	1945	1946*
Eastern states ..	156,264	138,300
Central states ...	164,232	162,500
Western states ..	293,844	265,000
Total	614,340	565,800

* November and December estimated.

The current reports thus indicate that our 1946 production of recoverable zinc in ore will be about 49,000 tons less than that of 1945. This decline in production from 1945 can be attributed to the numerous difficulties which confronted the industry in 1946.

Unfavorable Factors Influence Domestic Output

The industry clearly realizes that the current ore requirements of our zinc smelting plants have exceeded our domestic zinc in ore production and that it has been necessary to import foreign ores to meet existing demands. Present data indicate that our 1946 domestic production of recoverable zinc in ore may amount to 70 per cent of the zinc ore required by our smelters in 1946. Under more favorable conditions, our domestic ore production should supply a greater proportion of smelter requirements and thereby lessen the demand for imports. However, there are many national and international factors which will affect the situation.

While no new domestic zinc mines of outstanding importance have been brought into production during the past year, several of our mining and smelting companies have been conducting intensive exploration programs not only in their own and adjacent property, but also in old districts and new fields here in the United States and also in foreign lands.

As of November 30, 1946, this Government agency's reports indicated that it held 255,000 tons of recoverable zinc in ore and 188,000 tons of slab zinc to supplement the industry's 1947 production, should demand exceed supply.

Imports

Reports indicate that the zinc content of ore imports in 1946 will be less than the tonnages imported in 1945, but that of slab zinc may exceed the 1945 tonnage.

American Bureau of Metal Statistics, as of January 2, 1947, reports these imports as follows:

ZINC ORE (CONTENT)
TONS 2,000 LBS.

	11 Months Jan.-Nov. 1946	Year 1945
Canada	54,493	90,199
Newfoundland	8,813	23,516
Mexico	107,456	177,003
Argentina	8,295	.....
Bolivia	28,442	24,380
Peru	43,547	51,243
Australia	3,780	15,375
	254,826	381,716

ZINC BLOCKS, PIGS, Etc.

Canada	76,075	46,595
Mexico	15,277	36,104
Poland	551	.....
Australia	3,221	14,466
	95,124	97,165

The zinc content of 1946 ore imports is less than in any year since 1940, when it amounted to 180,000 tons, but substantially exceeds that of the years prior to 1940.

The available data indicate that the 1946 imports of zinc metal will exceed the record tonnage of 1945.

Obsolete Automobiles Should Increase Zinc Scrap

The tonnage of zinc scrap shipments to smelters and refiners in 1946 may amount to over 63,000 tons, thus exceeding 1945 shipments of 56,500 tons. The removal of price control will no doubt make available such stocks as dealers may have accumulated.

Our zinc refiners are cognizant of the fact that during the period 1935 to 1946 inclusive, our consumption of zinc base alloys in die-cast products has exceeded a million tons and that the automobile industry has used a substantial proportion of this tonnage in radiator grills and other easily salvaged fixtures. As new cars become available and old cars are scrapped, we can expect an increasing tonnage of die-cast scrap will become available. To this must be added a substantial tonnage from the reclamation of obsolete zinc alloy stamping dies from the aircraft industry.

1946 Zinc Consumption More Than Double That of 1939

The following data obtained from the American Zinc Institute give our available information on Slab Zinc Consumption in 1946.

In 1946, galvanizing continued its usual peacetime position as the largest market for slab zinc. The consumption would have been greater if the galvanizers could have obtained more steel to coat.

An important change in consumption is that of zinc base alloys, which market for the first time has assumed the No. 2 place in importance of tonnage use of zinc. The actual number of companies making zinc alloy die castings—which is by far the major part of this tonnage—has more than doubled in the last five years, and the 1946 consumption of zinc for die casting is more than twice that of 1939, the last year unaffected by war conditions.

The strikes which closed brass mills for an extended period in the early part of 1946, together with many factors which have slowed up reconversion where brass is prominent—the construction industry in particular—have caused the use of zinc for brass to fall well behind most of the years immediately preceding World War II. While brass making fell from second to third place among markets for zinc, it still consumed a very substantial tonnage of zinc, i.e., 140,000 tons.

SLAB ZINC CONSUMPTION
Tons of 2,000 lbs.

	1946 *	1945	1944
Galvanizing	315,000	337,000	316,000
Brass Products	140,000	259,000	381,900
Zinc-base Alloys	200,000	131,000	84,500
Rolled Zinc	93,000	98,000	76,500
Others	25,000	27,000	29,700
	773,000	852,000	888,600

* American Zinc Institute. October, November and December estimated.

The consumption for rolled zinc was the second highest in history, its 93,000 tons beng topped only by the year 1945. This was achieved despite one prominent producer being on strike for nearly half the year.

In addition to the consumption of zinc materials to produce zinc metal, a substantial tonnage of lead free and leaded zinc oxide derived directly from ore and from scrap is consumed by the paint and rubber industries.

While the supply of rubber tires is expected to catch up with the demand in 1947, the requirements of the paint industry for these pigments will be limited only by the availability of the other components of paint.

The consumption of zinc in 1946 by the industries using these pigment products will exceed 150,000 tons.

Exports Go to Over 14 Countries

Shipments of slab zinc, including drawbacks, which moved from smelters in 1946, intended for export, will probably exceed 60,000 tons. This is a substantial increase over similar shipments of 1945, 9,400 tons; 1944, 7,000 tons; and 1943, 56,000 tons, and far exceeds pre-war exports.

These exports were made to more than 14 different countries. Among them, the United Kingdom, Belgium, Argentina and Switzerland imported the larger tonnages.

Metal Prices

It has been well said that the cure for high prices is high prices. This applies to the non-ferrous metals, as well as to other commodities. As soon as the supply of non-ferrous metals is sufficient to meet demands, we can expect an adjustment of metal prices to a base where each metal will have the market in the particular field to which it is best adapted.

Should the price of zinc and its alloys increase to where they are out of line with competitive metals, a prompt price adjustment must take place under competitive conditions.

Present conditions no doubt warrant present prices, but as to this, I would call attention to the editorial in *American Metal Market* of January 3, 1947, under the caption "Caution Should Be the Watchword For Metal Buyers." From this editorial the following two paragraphs are quoted:

"The scarcity of supplies is a genuine fact, the increase in production costs is an actuality; the demands bear the earmarks of only reflecting the material needed to satisfy the orders for durable goods, but there is no harm to keep in mind that prices are very high and also, that there have been times when some mighty big changes have occurred in this country within the space of six or nine months.

"No early break in the prices of the common non-ferrous metals is in prospect but caution should be the watchword for 1947, and consumers might do well to keep a close eye on their inventories."

Outlook Good for Future Production

The future of our industry and that of all metal industries is dependent upon sound Government policies which will maintain and promote aggressive and prosperous mining enterprises. During the war we mined ore reserves to meet demands. Additional ore reserves must now be developed to meet current requirements and future emergencies. Such reserves can be developed only by aggressive mining operations, encouraged by helpful Government policies which apply to tariffs, labor and taxes. The demands of our economy determine the ore requirements of our refineries and these, for our own national security, must be provided, as far as possible, by our domestic mines.

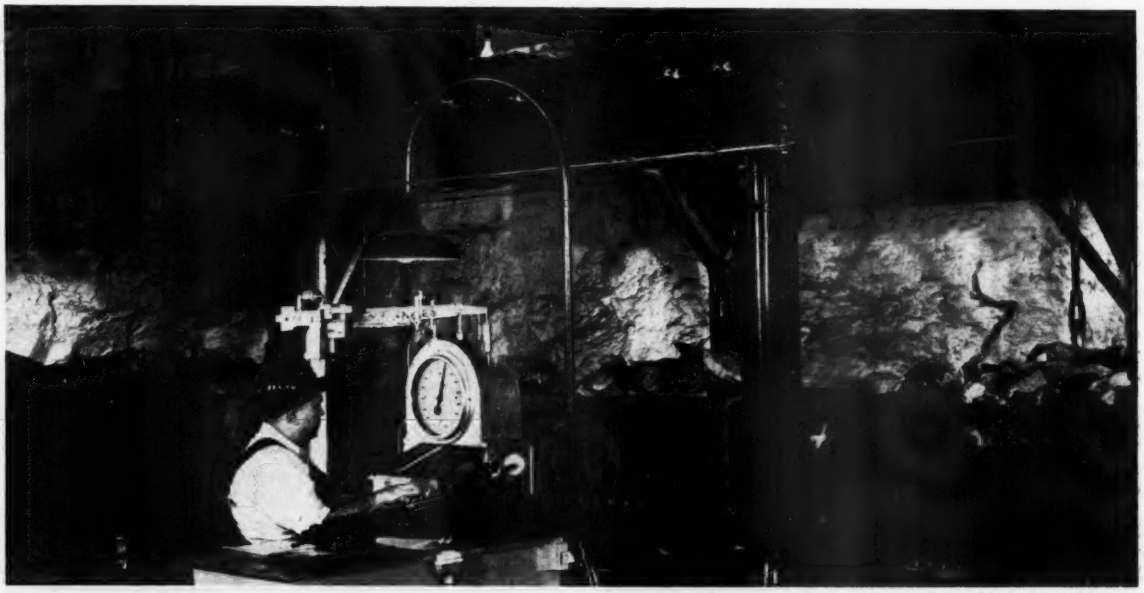
The necessity and value of having, at all times, our metal and other essential industries soundly established with efficient and technically skilled organization and sufficiently supplied with required ores, metals and materials, has been fully demonstrated in the past war. National defense, our economy, and our country's power to preserve world peace, require that these industries be so maintained.

The adoption of an unsound tariff policy in regard to the non-ferrous metals and their products, especially zinc, and/or restrictive legislation which would handicap our metal enterprises, would seriously hinder and indefinitely defer the search for and the development of additional mineral resources. Under such policies, this nation certainly in time would be in the "have not" category, with its position as a world power decidedly weakened.

Combined Metals Reduction Company operates an important zinc producer at Pioche, Nev.

During 1947, it is anticipated that the pressing demand for zinc and its products in some industries may be more nearly satisfied, thus permitting their diversion to other industries, where unsatisfied demand exists. Moreover, economists are predicting a period of adjustment in 1947. If such occurs, the demand for zinc may somewhat lessen. However, there still exists that large unfilled demand for zinc, which has accumulated during the war. We can well assume that, if the industry is permitted to operate in 1947 without interruptions, and without discouraging or hampering governmental action, the production of both ore and zinc metal in 1947 will substantially exceed that of 1946.

The long-range outlook for zinc and its products is bright. With the desired Government cooperation, sufficient and efficient labor and adequate prices for its products, the zinc industry can look forward to a bright and prosperous future. Such conditions will maintain a sound industry with high standards in labor rates and full employment, that will enable it to develop the additional ore reserves so essential to our economy and for future national emergencies.



Current zinc requirements have exceeded ore production

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By NEIL O'DONNELL
Executive Vice President
Idaho Maryland Mines Corporation

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Gold Mining in the Doldrums

TWO dates in recent times are remembered well by gold mine operators. The first is October 8, 1942, when all gold mines in the United States and Alaska were closed by Limitation Order L-208. The other date is July 1, 1945, when the order was rescinded.

Two facts are even more vividly remembered. The first is that economic loss was brought to the industry generally by L-208, and the second fact is that the cost of production of gold has risen so high since the commencement of the war that the majority of the mine operators have found that gold mining is either a business with greatly reduced profits, or an unprofitable business.

Although L-208 passed into history on July 1, 1945, the effects of its existence are still with us. When the gold miners were ordered to close their properties on October 8, 1942, no provision was made to lighten the inevitable burden which was to descend on their shoulders. No gold mine operator came through the 33-month period of closure without suffering serious losses, and in many cases the mine owner was ruined financially.

If any lesson is to be learned from the issuance of L-208, it is that a shutdown order is a weapon of fearful potentiality. The passage of this order and the subsequent refusal of the government to indemnify the operators is an occurrence which should give not only mine operators, but all citizens to pause and consider. A precedent is being established which might touch not only mining concerns, but any citizen. Who shall say "No" tomorrow if a Bureau of the Federal Government orders your business closed for 33 months?

Efforts have been made to secure reparations from the Federal Government through bills introduced both in the Senate and House. Senator Murray (D), Montana, introduced S. 1497. This bill was sent to the Claims Committee of the Senate, chairmanned by Senator Ellender of Louisiana, where it was tabled. Representative Clair Engle (D), of California, introduced H. R. 4393, which was referred to the War Claims Committee. Hearings were held on this bill on December 18, 1945, February 14 and 15 and March 11, 1946.

"The Bretton Woods Agreement provides, provisionally, a gold standard for the entire world which brings again recognition of the values inherent to gold."

L-208 Did Not Release Many Miners for Base Metal Operations

A comprehensive record was built up which proved beyond doubt that the Order did not accomplish its avowed purpose, i.e., to secure a large number of miners for the base metal mines. In addition ample proof was presented, that not only were a very limited number of miners secured, but that devastation was brought to the industry. Mr. Engle's bill was not brought to a vote during the session of the 79th Congress and expired with the Congress. It will be re-introduced in the present Congress.

In order to alleviate the depressing economic outlook, strenuous efforts were made to secure a higher price for the metal during 1946. These efforts took the form of requesting the Treasury Department for the right to export newly mined gold to foreign markets where a price higher than $35 per ounce prevailed. This request was presented in various forms and all were denied by the Treasury. A request for the right to sell newly mined gold in a free domestic market was also frowned upon by the Treasury. Mr. Engle has notified me that he intends to introduce bills in the present Congress for the free sale of newly mined gold in both the domestic and foreign markets.

If the war has not brought prosperity to the industry, it has brought to them a keener perception of the relation between their business and the country's financial structure upon which their business is dependent. They have studied the Bretton Woods Agreement with as much care as have bankers. While it can hardly be said that they are now masters of all the intricate problems of money, credit and prices, it can be said that their

understanding of such problems are greater than they have ever been.

Gold mining is unique among industries in that it prospers in periods of depression and it suffers in periods of national prosperity. It has suffered in times of war, especially in countries of established credit. In countries whose credit is not so well established the gold mines are kept operating in war times in order to pay the costs of war and maintain credit. In almost all countries gold mines are operated at a high rate on the termination of hostilities to pay the debts incurred in wartime. Today we witness the phenomenon of the world recovering from its most disastrous war, with all countries in debt, and the gold mining industry in a lethargic condition in the principal gold producing countries.

Unsound Thinking on Currency Matters

This prevailing condition of the world's mines is in part due to the growth in modern times of the idea that a gold backing for currency is unnecessary and that the credit of the nation back of its currency is sufficient. This hypothesis has a companion hypothesis, that the economy of a country could be better managed if the paper currency did not have a fixed value in terms of gold because the gold value of the currency could be adjusted in order to allow goods to be produced at prices which were competitive in world markets. By being able to sell goods at all times competitively, a nation could maintain a uniform level of employment, is the thesis. The latter argument is the one advanced for the abandonment of a gold standard. Universal acceptance of the either above ideas would constitute a serious threat to the future of the gold mining industry. Fortunately for the industry neither of the above ideas are practical.

The first idea is not new, but an old one dressed in new clothes. The idea has been tried innumerable times and has a basic weakness. The weakness is that no limit was placed on the amount of currency that may be issued and sooner or later so much is issued that all is rendered valueless, despite the backing of the government. The real solution in this case is the use of a fixed gold value for the currency which provides an automatic brake on the issuance of paper.

The second hypothesis is also unsound, because cutting of currency values is a poor substitute for national efficiency and can only result in reduced living standards for the people. The real solution is not in the unilateral cutting of currency values, but in the promotion of production efficiency.

The Bretton Woods Agreement Recognizes the Gold Standard

Again fortunately for the industry, the formulators of financial policy have seen the errors of their ways and are trending back again to a sounder basis. Whether the failures to maintain currency values in China, Greece, Italy, France and other countries has had a sobering effect on these gentlemen or not I cannot say, but undoubtedly it has pointed out again, if any such lesson was really needed, that currencies without gold backing are at best fair weather friends.

The Bretton Woods Agreement provides, provisionally, a gold standard for the entire world which brings again recognition of the values inherent to gold. There remains only the problem of seeing that enough is produced to meet the requirements of the World Bank and the Monetary Fund.

Due to the decreasing grade of the world's deposits and the world-wide increase in cost of production, a higher price should be established for gold which would guarantee the exploitation to the fullest extent possible of the lower grade fractions of all known deposits. The Bretton Woods Agreement provides for a changing of the price of gold without changing the credit structure in its Section 7, which I quote:

> "Uniform changes in par values.—Notwithstanding the provisions of Section 5 (b) of this Article, the Fund by a majority of the total voting power may make uniform proportionate changes in the par values of the currencies of all members, provided each such change is approved by every member which has 10 per cent or more of

The "Doodle Bug" is a familiar sight at California placers

Hydraulic mining is still a source of domestic gold

the total of the quotas. The par value of a member's currency shall, however, not be changed under this provision if, within seventy-two hours of the Fund's action, the member informs the Fund that it does not wish the par value of its currency to be changed by such action."

The multilateral changing of the value of paper currencies in terms of gold may thus be done without disturbing the relationship of world currencies one to another.

It is the belief of many people both in mining and in banking circles, that the time is coming, and is not far off, when Section 7 of the International Monetary Fund Agreement will have to be invoked with the view of raising the price of gold in terms of the paper currencies of the world. I share that belief.

The Price of Gold May Have to Be Increased

In the richer properties today the profit margin has been greatly reduced; the medium grade mines are just about breaking even and the lower grade mines find they cannot operate profitably. This is true not only in the United States and her possessions, but also throughout the world, if one gives credence to extensive reports in the foreign press. The difference between the cost of production and the selling price of an ounce of gold must be increased if the gold mining industry is to operate on the same scale in the post-war world that it did in the pre-war world.

This margin may be increased in one of two ways; either by reduction of operating costs or increase in the selling price of the product. Gold miners do not look with any hope toward the idea of cost reduction in a world of rising costs. Their thinking has been entirely about an increase in the price of gold. They fully realize that gold, occupying as it does the position of a monetary base, will not be given consideration as a commodity such as lead, copper or zinc. The problem of adjusting its price to meet the rising costs of production is a more complex problem which affects the purchasing power of money, everyone's money. If it were treated as a commodity, its price would have gone up long ago. Any price adjustment must therefore be determined on the monetary level and not on the commodity level.

What are the hopes that its price may be readjusted on the monetary level? There are many in my belief. Mexico is selling gold to any purchaser at $40 per ounce. Other countries are buying gold at prices higher than $40 per ounce. This gold is going to hoarders who fear a decrease in the value of their currency, or to people in countries where the currency has been greatly reduced in value where the people are using gold to protect equities.

That, however, is not the basic reason for my belief that the price will be advanced. In my opinion the price of gold cannot vary unless there is a great shortage or a great oversupply. Currencies fluctuate in value as against gold rather than the reverse. We have now a decreased supply of gold due to the war and to increased operating costs and we have also a devalued currency. The dollar will not buy today what it bought in 1939. The problem is not entirely one of getting a higher price for gold, but one of reestablishing the old price in terms of a new lower valued dollar. So it is most probable that a new price will have to be established that will take care of both phases of the problem, shortage of supply and reestablishment of price relationship.

There are some who will question the statement of a new lower valued dollar. I wish only to call attention to the Federal budget now under discussion of more than 37 billions of dollars. This sum exceeds the total value of all goods and services produced in the United States in any year prior to 1914, and almost equals the value of all goods and services produced in the years of 1916, 1921 and 1932; and remember that these are only Federal taxes. We have, whether we wish to admit it or not, a new lower valued dollar with us now.

"No gold mine operator came through the 33-month period of closure without suffering serious losses, and in many cases the mine owner was ruined financially."

Production Figures Indicate Decline

The production of gold in the United States and Alaska reached its peak in 1940, with a production of 4,869,949 oz. from all sources, of which 4,217,438 oz. were from gold mines. The figures for gold production since then are shown in the table below.[1]

Those mines which could operate during 1946 found that their most serious operating problem, in common with base metal mines, was a shortage of men. There not only was a shortage of trained men, but there also was a shortage of men that could be trained. The gold mines, like the base metal mines, will have to train men to replace the personnel lost during the war period.

Some materials were in short supply, but generally I believe the operators devised ways and means to surmount this difficulty. Their principal difficulty, they found, was in earning a profit from their operations.

As Father Time rings down the curtain on 1946, he rings it down on what a disconsolate industry considers the worst 12 months for gold mining since the discovery of gold in California, excepting, of course, any 12 months of the 33 months of L-208.

The production by States and Alaska is given in the following order.

State	Ounces[2]
California	348,000
South Dakota	311,600
Alaska	192,527
Utah	158,500
Colorado	137,210
Nevada	88,500
Arizona	78,300
Montana	68,600
Washington	54,500
Idaho	41,550
Oregon	18,529
New Mexico	3,968
Wyoming	105
Texas	10
Total	1,503,553

[2] Figures from Bureau of Mines, with December production estimated.

Year	Placers	Dry and Silicious Ores	All Other Sources	Total Production
1940	1,511,469	2,705,969	652,511	4,869,949
1941	1,487,635	2,582,743	680,467	4,750,865
1942	1,013,702	1,729,636	713,772	3,457,110
1943	158,364	522,663	682,788	1,363,815
1944	123,322	297,971	577,101	998,394
1945	184,663	285,020	484,889	954,572
1946	Not available			
				16,394,705

[1] Bureau of Mines figures quoted in "American Bureau of Metal Statistics, 1944."

California—Of the total production, placer mines produced approximately 75 per cent and lode mines 25 per cent.

Yuba Consolidated Gold Fields operated four dredges throughout the year and one dredge a portion of the year in Yuba County, two in Butte County and one in Siskiyou County a portion of the year. The Natomas Company operated all of their seven dredges throughout the year. The Gold Hill Dredging Company operated two dredges in San Joaquin County and one in Butte County.

Connected bucket line dredges were operated by the Snelling Gold Dredging Company, the Capital Dredging Company, the Lancha Plana Gold Dredging Company, French Gulch Dredging Company, Thurman Gold Dredging Company and the Junction City Mining Company. A number of dragline operations were reopened in 1946. Some hydraulic operations were resumed on limited scale. Small productions were reported by one drift mine and several gravel companies who recover gold during the process of mining gravel.

Approximately two-thirds of the gold derived from lode mines in 1946 was produced in the Grass Valley area. The Idaho Maryland Mine was the largest producer. The Empire Star property which operated greatly below its pre-war rate through the early part of the year closed on July 1. The management reported that high costs made the operations unprofitable. The Ancho-Erie Mine in the Washington area greatly increased its output and gave promise of developing into an important producer. Along the mother lode, the important shippers of bullion were the Mt. Gaines and Eagle Shawmut. The Tropico Mine of Burton Brothers at Mohave produced 1,000 oz. The Original Sixteen to One property at Alleghany operated throughout the year as did the Brush Creek property in Sierra County.

South Dakota — The Homestake Mine at Lead accounted for the bulk of South Dakota's production. This property was able to reach only about 50 per cent of its pre-war output. The Bald Mountain Mining Company was the only other producer in South Dakota with about 50 per cent of its pre-war production. Both of these properties are lode mines.

Alaska—As in California, the production of gold from placers increased at a higher ratio than the production from lodes. The principal placer operations were those of the United States Smelting, Refining and Mining Company at Fairbanks, the Artic Circle Exploration Company on Candle Creek, the New York-Alaska Gold Dredging Company on the Tuluksak River, Alluvial-Golds, Inc., on Woodchopper Creek, Gold Placers, Inc., on Coal Creek, Brinker-Johnson on Caribou Creek, C. J. Berry Dredging Company on Lower Mammoth Creek, Wade Creek Dredging Company on Wade Creek, Caribou Mines on Caribou Creek and Bristol Bay Mining Company on Watamuse Creek.

The Cleary Hill Mines, Inc., in the Fairbanks district and the Gold Cord Mining Company, Willow Creek district, were the principal operators of lode gold mines.

Utah—Utah was the leading producer of gold during the period the gold mines were closed. Utah not only dropped back to fourth place when L-208 was rescinded, but its production dropped an estimated 43 per cent as against production in 1945. About 95 per cent of Utah's production is derived from copper, zinc and lead mines, 80 per cent being derived from the former and 15 per cent from the latter. Continued strikes at these properties accounted for the drop in production in 1946.

Colorado—Colorado's production of gold increased in 1946 about 36 per cent. Increased lode mine operation in the Cripple Creek area, and increased dredging in Park County area accounted for the increases.

The Cripple Creek area is Colorado's principal source of gold. This area produced three-fourths of gold produced in the State in 1946. Its increase in production was 67 per cent over 1945, but that amount was only about one-third of its 1941 output. All the ore produced in the district was milled at the plant of the Golden Cycle Corporation at Colorado Springs. The principal producing properties were those of the Golden Cycle Corporation, the Portland and Vindicator Mines of the United Gold Mines Company, the Stratton Estate Group and the Cresson Consolidated Gold Mining and Milling Company. The Cresson property reopened on April 1 for the first time since the rescision of L-208. On July 22 a cave-in occurred which necessitated closing the property for several months. The Cresson was the largest producer in the Cripple Creek area in pre-war years.

Nevada—Nevada's gold production decreased during 1946 about 4 per cent.

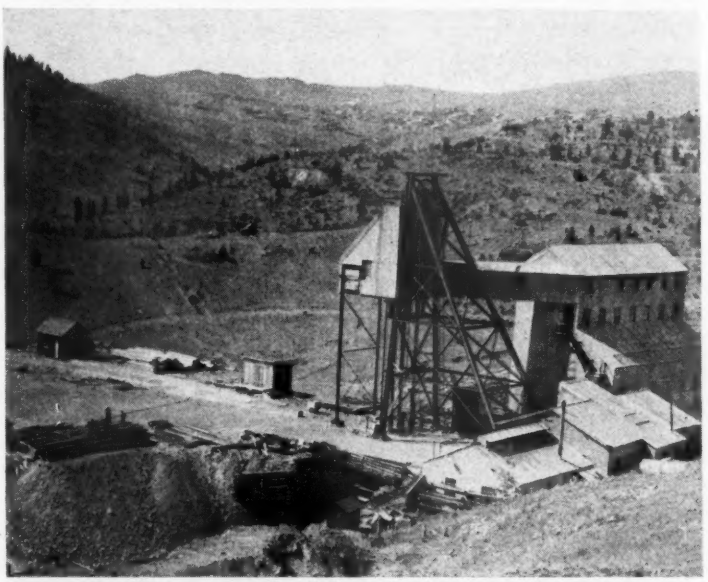
Three large copper mining companies account for approximately one-half of Nevada's production. These are the Kennecott Copper Corporation, Consolidated Coppermines Corporation and the Copper Canyon Mining Company. The first two are first and second in production in that order.

The third largest producer was the Manhattan Gold Dredging Company, Manhattan District, Nye County. The only other important operating company was the Consolidated Chollar Gould and Savage Mining Company, Comstock District, Storey County, which ranked fourth in production.

Arizona—Arizona's production in 1946 was slightly above 1945 production. Nearly all of Arizona's production is a. by-product of copper and lead-zinc operations.

Montana—Montana's gold production showed an increase of 220 per cent over 1945, while the production of silver, lead, copper and zinc declined. The leading producers in order were: Winston Brothers, Jef-

(*Continued on page* 95)



A gold mine with much promise is the El Paso at Cripple Creek

Silver at the Crossroads

By a Special Correspondent

THE year 1946 finds silver at the crossroads. The course pursued during the next two years will determine the future of silver for a long time to come.

There is admittedly a scarcity of the metal for industrial uses throughout the world. Although it has not been generally accepted, a shortage of silver for monetary uses is imminent. This latter category is the more important of the two. It has always been so. Most of the countries of Europe, the Middle East, and the Far East in particular, are greatly in need of silver coinage. During the past two years the United States Government has minted silver coinage for Australia, Ethiopia, Fiji Islands, the Netherlands, and Saudi Arabia. The quantity of silver thus minted amounts to approximately 100,000,000 ounces.

United States legislation overshadowed all other activities during 1946 in connection with silver. Bills were dropped into the hopper on Capitol Hill by Senator McCarran of Nevada, Senator Green of Rhode Island, Senator Murdock of Utah, Congressman Martin of Massachusetts, and Congressman Celler of New York, and important amendments to the Treasury-Post Office Appropriation bill were offered by Congressmen Rooney of New York and White of Idaho, and Senators McCarran of Nevada and Hayden of Arizona. The bills and amendments introduced by Senators and Congressmen from Eastern states resulted in the enactment of legislation which established a peacetime precedent in the United States of authorizing the sale by the Treasury of nonmonetized silver for industrial uses *at not less than* 90.5 cents per fine ounce, and the bills and amendments introduced by Senators from Western states also resulted in establishing a precedent since "The Crime of 1873" whereby the producers of domestically-mined silver were assured of receiving from the United States Treasury, without time limit, 90.5 cents per fine ounce for silver produced within the continental limits of the United States after July 1, 1946. Therefore, 90.5 cents per fine ounce has been set by law as a bottom price at which Treasury silver may be sold for industrial uses, and as a fixed price at which the entire output of domestically-mined silver must be purchased by the Government for monetary purposes, if and when tendered by the domestic producer.

A Compromise Price is Agreed Upon

The compromise price of 90.5 cents per fine ounce was reached after prolonged consideration in the House and Senate Appropriations Committees, the Senate Banking and Currency Committee, and debate on the floor of both the United States Senate and House of Representatives. Senators and Congressmen from the West were desirous of establishing a temporary Treasury buying price of $1.03 per fine ounce and a permanent buying price in two years of $1.29 per fine ounce for domestically-mined silver. Senators and Congressmen from Eastern states attempted to secure statutory authority for their silver-manufacturing constituents to purchase silver from the United States Treasury at 71.11 cents per fine ounce or less.

"Although it has not been generally accepted, a shortage of silver for monetary use is imminent."

The chief arguments of the Eastern Senators and Congressmen were that the silver manufacturing interests required silver during the period of reconversion at a price that would enable them to meet the demand for higher wages and to manufacture silverware for war brides at no advance in price.

Eastern Congressmen and Senators were so anxious to have legislation enacted for the benefit of their constituents that they urged the enactment of an amendment offered in the House Committee on Appropriations by Congressman Rooney of New York to the Treasury-Post Office Appropriation bill rather than to press for action on Congressman Martin's bill, which passed the House of Representatives and reposed in the files of the Senate Banking and Currency Committee for several weeks. Although there is a House rule against attaching legislation to an appropriation bill, Congressmen from the thickly populated Eastern states, greatly outnumbering those from the Western states, appealed to the House Committee on Rules to sponsor a resolution waiving a point of order against Congressman Rooney's amendment. Such drastic action is seldom resorted to, the Eastern Congressmen having evidently been aware of the probability that some Congressman from a Western state would take occasion to raise a point of order against the amendment of Mr. Rooney, and thereby defeat it.

When the smoke of battle cleared away Eastern Senators and Congressmen realized they were fortunate to get Congressional approval of legislation authorizing the sale of Treasury silver at not less than 90.5 cents per fine ounce, whereas Senators and Congressmen from Western States were not so highly pleased to vote for legislation which would enable producers of domestically-mined silver to receive only 90.5 cents per fine ounce. Eastern industrialists realized that unless a ceiling was kept on silver for industrial uses they would be required to pay somewhere between $1 and $1.50 per fine ounce for their silver. On the other hand, the silver producers of this nation knew that a bottom price of 90.5 cents per fine ounce for their silver would not be sufficient to enable them to mine the metal profitably on a normal production basis; that is, they knew that the normal production of 60,000,000 oz. per year of domestically-mined silver could not again be reached unless they get a price considerably above 90.5 cents per fine ounce. Since the demise of OPA, higher prices for copper, lead and zinc have resulted and are helpful to the miner, but when and if these prices decline later on, a higher price for silver would exert a decisive influence on the production of these base metals, of which silver is an important byproduct. Domestic silver production is of very little interest to Eastern Senators and Congressmen as their manufacturing constituents have in the past (except during World War II) depended on foreign silver for their source of supply.

The British Plan to Withdraw Silver Coinage

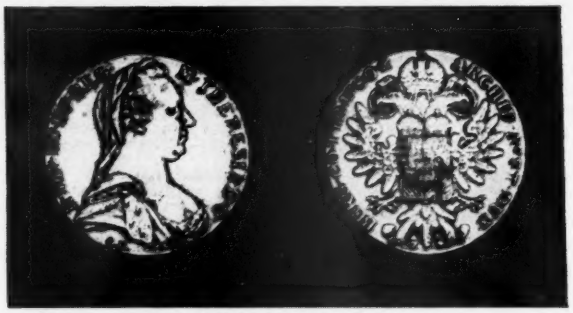
Within a fortnight following the battle on silver in the United States Congress, Sir Hugh Dalton, Chancellor of the Exchequer, announced that legislation would soon be offered in the British Parliament designed to withdraw from circulation all silver half-crowns, florins, shillings, six-pences and three-pences [1] for the purpose of melting them down and extracting the silver therefrom to be used to repay in kind the silver debt to the United States of 88,073,878.21 fine ounces lend-leased during World War II, and to provide a stockpile for sale to silver-using industries in the British Isles. The silver coins to be withdrawn from circulation are composed of 50 per cent silver, 40 per cent copper, 5 per cent nickel and 5 per cent zinc. The new substitute coinage of the same denominations will be composed of 75 per cent copper and 25 per cent nickel. The agreement under which this silver was lend-leased to Britain requires repayment in kind to the United States Government within five years after the President declares World War II to have ended. This period may be extended an additional two years by mutual agreement.

British statisticians estimate that a total of 221,000,000 fine ounces of silver would be recovered as a result of this withdrawal. They also estimate that the program of demonetization will yield at the rate of approximately 50,000,000 ounces per annum and that four and one-half years will be required to complete the demonetization program. There is at present an industrial demand in the British Isles for 15,000,000 oz. annually. Also it is expected that some of this redundant silver will be exported to India and other colonial possessions to meet coinage and industrial demands.

Under this program the British Government would be able to allocate 35,000,000 oz. of silver per annum for repayment of her silver lend-lease debt to the United States and still have 15,000,000 oz. for sale to industry. If this schedule is adhered to, at the end of five (or seven) years Britain will have repaid her silver lend-lease obligation of 88,073,878.21 oz. and to have sold for industrial uses 75,000,000 oz., making a total of 163,000,000 oz. of silver. This would leave a stockpile of 58,000,000 oz. which Britain could and probably would use to swamp bullion markets throughout the world in order to reduce and maintain the world price at a low level.

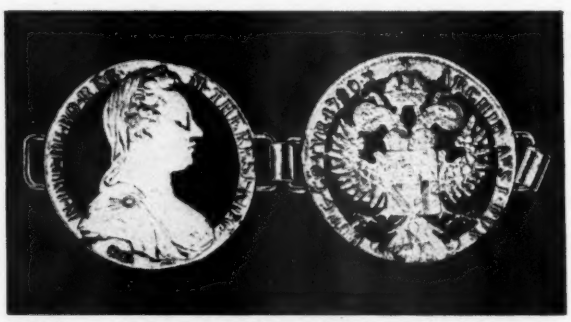
The danger in this situation lies in the possibility that Britain may not elect to repay her silver lend-lease debt before the expiration of five (or seven) years after the war is officially declared to have ended. In that event Britain would have 35,000,000 oz. of silver per annum to throw upon the markets at such times and places as would be deemed most expedient in order to carry out her purpose of devaluing silver throughout the world.

[1] Two coins not included in this legislation are the English shilling and two-shilling piece in current use in the Sudan; also "Maundy money" consisting of the silver penny, two-penny, three-penny and four-penny pieces which are distributed on behalf of His Majesty. The silver content of these coins was reduced to .500 fine in 1920, but their original fineness of .925 will be restored immediately.



THE MARIA THERESA DOLLAR

This obsolete silver coin, until recently the currency of Ethiopia, has had a curious history. Originally minted when Maria Theresa was Empress of Austria, in some mysterious way it became the coinage of Ethiopia and acceptable as currency throughout the Red Sea area, much of Arabia, and East Africa. The coin has been minted by many nations including England, France and Italy, all of whom used it as a trade dollar. Every coin bears the date 1780 irrespective of the actual minting date. Despite all efforts in the past to introduce other coinage to the region, the Maria Theresa dollar has persisted. Haile Selassie, the present Emporer of Ethiopia, is trying to introduce modern coinage and a predecessor, the Emperor Menelik, made a similar attempt over forty years ago. So far none of these efforts have been successful—the populace have faith in this dollar only. In 1943 Ethiopia was flooded with newly minted Maria Theresas carrying the intials S.F. under the head of the queen on the obverse side. The coin was worth 60c American currency.



Links from a Maria Theresa dollar belt, an unusual Ethiopian curio

Silver Withdrawn from the Indian Rupee

Another important event which occurred on June 16, 1946, was a decision by the Reserve Bank of India (which is under the control of the British Government of India) proclaiming that the minting of half-rupee and quarter-rupee silver coins will be suspended, and that as fast as those now in circulation are returned to the bank they will be melted down and the silver extracted therefrom; and that new substitute coins of cupro-nickel will be minted and circulated in their stead. Like the British silver coins, the subsidiary silver coins of India are of a fineness of .500 having been reduced a few years ago from .800 fine. An estimate of the amount of silver in the Indian coins to be melted down is not available at this time, but the amount is not large enough to repay in full India's silver lend-lease debt to the United States of 225,999,903.83 fine oz.

There is another inherent danger in the situation. Other member countries of the Commonwealth which are beneficiaries of our silver lend-lease program during the recent war might follow the example of the mother country. If similar measures are taken elsewhere, the effect on

silver prices throughout the world could be catastrophic.

Great Britain's obligation is a heavy one for she has quite recently underwritten India's silver lend-lease obligation [2] which amounts to 225,999,903.83 oz. Her obligation will probably be further extended to other British possessions which are beneficiaries of lend-lease silver.

But when we consider the silver lend-lease debts of Great Britain and India alone, which amount to a total of 314,073,782.04 oz., it is very plain that Great Britain does not have in her currency system enough silver to enable her to meet these obligations.

Can Britain Repay Her Silver Debt?

Great Britain probably realizes that she will be unable to return enough silver to the United States Government to discharge in full her lend-lease obligation. Why should Britain be particularly interested in repaying her silver debt when there is already outstanding a debt to the United States of $4,200,000,000, on which has accrued and remains unpaid $2,000,000,000 interest, contracted shortly after the close of World War I, and a new debt in the form of a credit of $3,750,000,000, a loan of $650,000,000 in settlement of lend-lease obligations other than lend-lease silver, together with the unpaid portion of the RFC loan extended in 1941 amounting to $210,000,000? There is also in several countries of the world, composed largely of her colonial possessions, a huge blocked sterling debt aggregating over $4,000,000,000 which is of considerable importance to Britain because of its direct bearing on her foreign trade. The liquidation of this block sterling far transcends in importance the discharge of her silver debt to the United States. Britain's ability to discharge her financial obligations is so doubtful that she is probably not seriously concerned over the return of lend-leased silver to the United States Treasury. Great Britain's chief interest probably is to utilize her lend-leased silver in a manner designed to not only decrease the world price of silver but to discourage its use as money throughout the world. This has been Britain's attitude since 1816.

One of the arguments used in the debates in Parliament in support of the new silver demonetization bill is that silver costs too much. Let us examine this argument. The fact is that the melting point of the British coins soon to be melted down is $2.57 an ounce. (This means that if the market price of silver should go above $2.57 an ounce it would then be profitable to melt down the coins and sell the silver as bullion.) If Britain should buy silver at 90.5 cents an ounce for use in her silver coinage of today, she would realize a profit (seigniorage) of the difference between 90.5 cents and $2.57, or $1.665 on every ounce bought and used for coinage. Contrast the profit of $1.665 an ounce in Britain with a profit of 38.79 cents an ounce accruing to the United States Government on silver purchased at 90.5 cents an ounce and coined into silver dollars which have a melting point (monetary value) of $1.29 an ounce.

If instead of preparing to denude her coinage system of silver Britain were acquiring 221,000,000 oz. of silver at 90.5 cents an ounce for use in coins having a melting point of $2.57 an ounce, she would make a profit (seigniorage) of $367,965,000.

On the other hand, if Britain should sell at 90.5 cents an ounce all of her 221,000,000 oz. which she expects to recover from her silver coins now in circulation she would receive only $200,005,000 for all of her silver, or $167,960,000 less than the circulating value of the coins.

The Cheapening of Her Currency Causes Concern in Britain

Therefore, Britain, unless there were some ulterior motive involved in her scheme, would find it more profitable to buy and coin silver than to melt down her coins and sell the resultant silver. Of course, a greater profit will accrue to Britain by substituting nickel and copper for silver. Why not use paper subsidiary notes and realize a still greater profit? But to maintain that silver at 90.5 cents an ounce is too expensive to be used in coins that have a circulating value of $2.57 is an absurdity.

And what about the man on the street? How will he react to this change? From a casual reading of the debates this question has caused an alarming concern to many members of both Houses of Parliament who expressed deep regret over the further cheapening of Britain's currency by abandoning the use of silver coins after 1,000 years, and the fear of an adverse effect on her credit throughout the world. This is regarded as a step in the wrong direction as some members urged that an extension of the repayment period of five (or seven) years be proposed to the United States Government.

The repayment period could, no doubt, be extended by Executive agreement to 10 or even 20 years if Great Britain should elect to so request. But no such request has been made.

It seems strange to Americans that Great Britain after having been made the greatest beneficiary of the lend-lease program now plans a step which is deliberately intended to lower the value of our Treasury silver and to discourage the use of this metal as money throughout the world.

This brief analysis of the latest move by the British Government in a further effort to dethrone silver as money indicates very clearly that it is the purpose of that Government to continue its move away from the use of the precious metals as money and in the direction of a paper (promise-to-pay) standard.

In 1920 Britain waged a similar fight against silver by drastically reducing the silver content of her coins from .925 fine to .500 fine and auctioning much of the resultant silver on the Shanghai bullion market. This action followed another philanthropic act on the part of the United States Government in 1918 whereby silver dollars were melted down and 200,000,000 fine ounces of residual silver were sold at $1 an ounce to Great Britain and coined into Indian rupees in order to redeem an amount of paper rupees in circulation beyond the capacity of the silver reserves of the Bank of India. This generous action by the United States Government forestalled a revolution in India, according to Lord Reading, then British Ambassador to the United States.

The effect of this unfortunate move was to reduce the world price of silver at least 50 per cent within a period of about a year. The Shanghai silver market was swamped with British silver. Auction sales of silver followed which had a far-reaching effect upon the economy of China, then on a silver standard. The momentum of the price decline that ensued carried the world price to an

"New world production in 1947, while showing an increase, can hardly be expected to keep pace with the combined coinage and industrial demand, which will exceed that of 1946."

2 *The Economist*, August 10, 1946. Page 222.

all-time low (in 1932) of 24½ cents an ounce.

China's Abandonment of Silver Caused Wide Repercussions

Much has been written of the abandonment of the silver standard by China as having been attributed to the effects of silver acquisitions by the United States under the Silver Purchase Act of 1934. This accusation cannot be sustained. The fact is, however, that the decline in the world price which began with the auction sales of silver in Shanghai in 1920 reduced China's purchasing power abroad, and at the same time brought about a domestic inflationary condition as a result of cheapening China's currency at home. This inflationary condition was construed by many writers as being economically healthful, but like other inflationary booms the aftermath was destructive. The world price of silver rose in 1933 to 45.3 cents an ounce, an increase of 80.8 per cent. This was prior to the passage of the Silver Purchase Act of 1934. After the passage of the Act Great Britain despatched Sir Leith Ross to China (in 1935) at which time the Chinese Government was induced to abandon the silver standard and adopt the gold standard.

While on the subject of the Silver Purchase Act, it may be well to mention the alertness of Great Britain whereby she became the greatest beneficiary of that Act. Most of the silver acquired under the Silver Purchase Act of 1934 came from China, Japan, Great Britain and India. We purchased from China 502,297,000 oz. at a cost of $220,142,000, or an average of 43.8 cents an ounce; from Japan 2,875,000 oz. at a cost of $1,017,000, or an average of 35.4 cents an ounce; from India 3,687,000 oz. at a cost of $1,961,000, or an average of 53.2 cents an ounce; and from Great Britain 492,798,000 oz. at a cost of $301,917,000, or an average of 61.3 cents an ounce. The total amount of foreign silver purchased under the Silver Purchase Act was 2,047,039,000 oz. at a cost of $1,020,722,000, or an average cost of 49.9 cents an ounce.

Great Britain did not have in her possession 492,798,000 oz. of silver for sale at the time of the approval of the Silver Purchase Act of June 19, 1934. Most of this silver was purchased by Great Britain from Japanese, Chinese and Indian sources at a low price and resold to the United States Government at an average of 61.3 cents an ounce.

3 Report of the Executive Directors of the Board of Governors of the International Monetary Fund, November, 1946.

4 Hon. Antonio Espinosa de los Monteros, the Mexican Ambassador.

The Bretton Woods Resolutions

A move important to silver was made on September 28, 1946, by the Board of Governors of the International Monetary Fund [3] when the following resolution, offered by the able Governor for Mexico,[4] was adopted unanimously:

WHEREAS due to the shortage of time, the magnitude of other problems on the agenda, and other limiting factors, it was not possible to give sufficient consideration to the international aspects of silver, nor to make definite recommendations, at the time of the Bretton Woods Conference;

WHEREAS in Article I (i) of the Articles of Agreement of the International Monetary Fund it is stated that one of the principal purposes of the Fund is to promote international monetary cooperation through a permanent institution which provides the machinery for consultation and collaboration on international monetary problems;

WHEREAS it was the sense of the "Statement Regarding Silver" included in the Final Act, that the subject merited further study by the interested nations;

WHEREAS one of the prevailing factors of disequilibrium, accentuated by the disruptive forces of the recent war, is a distorted distribution of international monetary reserves, involving difficult problems of readjustment;

WHEREAS some member countries may consider of the utmost importance, to take the necessary measures to place their fiscal and monetary systems on sound bases, as a preceding or parallel condition to international action on other fundamental issues of monetary policy;

WHEREAS several member countries may contemplate the use of silver as a prime constituent, in their efforts to bring about the necessary fiscal and monetary reforms as well as in making other essential economic adjustments, but are hampered by technical and financial problems arising from the use of silver for monetary purposes;

WHEREAS the problem falls within the purposes set forth by the Fund Agreement, and several member countries are interested in it: Therefore, in recognition of these premises, the Board of Governors of the International Monetary Fund hereby

Resolves, That the Fund shall gather whatever material is available and obtainable on the monetary uses of silver: the real function of silver coins; risks and uncertainties of its monetary uses; possibilities of cooperation in the use of silver for monetary purposes, etc. In general, the Fund shall gather material, statistical or otherwise, which could be useful in facilitating discussions on the subject in an international conference among interested member countries.

Although the meetings held at Bretton Woods, New Hampshire, in 1944, failed to give consideration to the inclusion of silver along with gold for use as monetary reserves and in the settlement of international balances, Commission III adopted at Bretton Woods the following resolution:

"The problems confronting some nations as a result of the wide fluctuation in the value of silver were the subject of serious discussions in Commission III. Due to the shortage of time, the magnitude of the other problems on the agenda, and other limiting considerations, it was impossible to give sufficient attention to this problem at this time in order to make definite recommendations. However, it was the sense of Commission III that the subject should merit further study by the interested nations."

This "gesture" laid the foundation for the resolution adopted at the first annual meeting of the Governors last September.

If the International Monetary Fund gives impartial consideration to proposals of the interested member nations and makes an earnest effort to correct the evils of the past century perpetrated by Great Britain and Germany, in particular, in their attempt to deprive silver of its rightful place in monetary systems throughout the world, it is conceivable that an opportunity may soon be afforded to restore to silver a position of dignity and usefulness that should prevail throughout the world for an indefinite period.

Domestic Silver Production at Lowest Point in 75 Years

The industrial demand for silver for 1946, while not as great as during most of the recent war years, is estimated by Handy & Harman to have been 105,000,000 oz. If many of the silverware manufacturing plants in this country had not been closed during a part of the time when the recent silver legislation was under consideration, the estimated industrial consumption of 125,000,000 oz. would have been reached. The industrial consumption of silver during 1947 will probably not exceed that of 1946.

The domestic coinage consumption of silver was 40,000,000 oz. for the entire year of 1946. This is 10,000,000 oz. less than the Bureau of the Mint estimate submitted to Congress in January, 1946.

Imports of silver for 1946 reached a total of approximately 70,800,000 oz., the bulk of which came from Mexico and Peru in the form of ore and base bullion.

According to the Bureau of Mines the domestic silver production in 1946 was only 21,778,236 fine ounces. This figure is smaller than the low domestic production of 22,800,000 oz. in 1933—in fact, it is the smallest domestic production of silver in 75 years. The total production for the Western Hemisphere in 1946 was approximately 108,000,000 oz., and although definite figures are not available, world production during the year probably amounted to not more than 135,000,000 oz. New world production in 1947, while showing an increase, can hardly be expected to keep pace with the combined coinage and industrial demand, which will exceed that of 1946.

Aluminum and Bauxite

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By a
Special Correspondent

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The Nation's Aluminum Production Capacity Was Increased Seven-fold During the War. The Year 1946 Was a Period of Transition; the Industry Made Great Strides Towards Peacetime Production

IN 1946 the aluminum industry shattered all pre-war production records in a vain effort to meet post-war demand for aluminum, greatest in all peace-time history. The result of this record-breaking production has been to boost aluminum to a position as the number one non-ferrous metal of peace-time industry, in terms of volume produced.

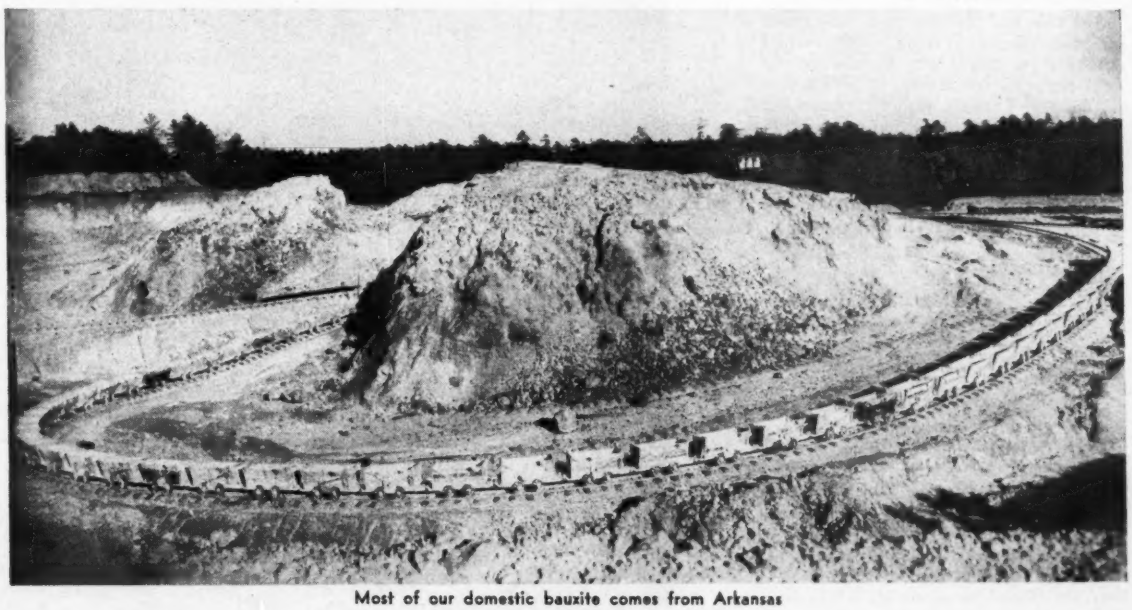
Although more aluminum was produced in 1946 than in any other previous peace-time year, actual production was 16 per cent less than in 1945. Strikes, material shortages and delays in disposing of war-built, Government plants and readying them for operation, held down production to approximately two-thirds of the nation's economical aluminum-producing capacity. By the end of the year, however, all Government alumina and aluminum smelting plants that could be operated economically under present conditions had been leased or sold to private companies, and the industry was producing at a rate 10 per cent greater than in 1945.

The aluminum industry made rapid strides during 1946 in gearing itself for greater peacetime production. The nation's total aluminum production capacity, expanded seven-fold during World War II, has now been largely reconverted to a sound economic basis. The industry's capacity, however, is still four times as great as in the highest pre-war year, and amounts to well over a billion pounds annually. With the Government-owned facilities, now in private hands, rapidly approaching full operation, production of new aluminum this year should be close to the rated annual capacity; the Civilian Production Administration recently estimated actual production may approximate 1,260,000,000 lbs.

Only War Years Exceeded 1946 Production

Production of primary metal in 1946 is estimated at 836,000,000 lbs., or 84 per cent as much as the 993,000,000 lbs. produced in 1945. Despite this 16 per cent reduction in output, 1946 production was almost three times that of 1938 (the last full pre-war year), two and one-half times as much as 1939 production, more than twice that of 1940, and 35 per cent greater than 1941 production. Only in the war years 1942-45 was production greater than in 1946.

Domestic output came primarily from the privately owned plants of the Aluminum Company of America at Alcoa (Tenn.), Badin (N. C.), Massena and Niagara Falls (N.Y.), and Vancouver (Wash.), and the Reynolds Metals Company at Listerhill (Ala.), and Longview (Wash.). A much smaller amount came from the Government-owned plants leased by Reynolds and Permanente Metals Corporation, a Henry J. Kaiser interest. Alcoa, which now owns half of the nation's privately-operated aluminum smelting capacity, produced aproximately 70 per cent of the nation's new aluminum in 1946. The Government-owned plants leased by Reynolds and Kaiser operated at only a fraction of their rated capacities during the year.



Most of our domestic bauxite comes from Arkansas

The Hurricane Creek Development

At the beginning of 1946 only the privately owned plants of Alcoa and Reynolds were in operation, the last of the Government-owned alumina and primary metal plants having been closed on October 31, 1945. Early in January, however, Alcoa granted the Reconstruction Finance Corporation a royalty-free license on patents covering the process of extracting alumina from bauxite at the Government-owned alumina plant at Hurricane Creek, Ark. This plant, which could not be operated on a competitive basis without the use of Alcoa's patents, was the key to the Surplus Property Administration's aluminum plant disposal program, for upon its operation depended the availability of an additional large quantity of low-cost alumina to prospective operators of the Government-owned smelting plants.

Immediately following Alcoa's patent gift, Reynolds leased the Hurricane Creek Works as well as one-half of the Government-owned smelting plant at Jones Mills, Ark. Later, Reynolds also leased the Troutdale (Ore.) smelting plant, as well as a number of Government-owned fabricating facilities. Kaiser entered the aluminum industry during the year by leasing from the Government the Baton Rouge (La.) alumina plant and the Spokane (Wash.) smelting and sheet rolling plants. Late in the year Kaiser purchased from the War Assets Administration the Tacoma (Wash.) smelting plant, which had been operated during the war by the Olin Corporation (now Olin Industries, Inc.).

By the end of the year all three of the leased, Government-owned smelting plants were in partial or near-capacity operation. The Kaiser-purchased Tacoma plant is expected to be placed in operation early this year. Of the five remaining Government-owned smelting plants, none have thus far been sold or leased. It has been stated that electric power is not available at reasonable rates to permit their economic operation.

With the entrance of Kaiser into the aluminum industry, there are now three primary aluminum producers, each of which is independent, privately owned, and largely integrated. The nation's annual economic capacity to produce aluminum is now close to 1,280,000,000 lbs, being divided up approximately as follows: Alcoa, 50 per cent; Reynolds, 30 per cent; Kaiser, 20 per cent. The nation's total capacity to produce alumina is about 4,855,000,000 lbs. yearly, or enough to smelt approximately 2½ billion lbs. of metal. Of the total alumina capacity, Alcoa has 43.7 per cent, Reynolds 35.9 per cent, and Kaiser 20.4 per cent.

Supplementing the 1946 production of primary metal was the Government stockpile of ingot, which was reportedly depleted by some 225 million lbs. Primary metal stocks held by the Government on January 1, 1946, totaled approximately 370 million lbs.; by the end of the year these stocks were estimated to be about 145 million lbs.

Secondary Aluminum Paralleled the Demand for Primary Metal

The production of secondary aluminum ingot in the first nine months of 1946 totaled 283,442,000 lbs., according to the Bureau of Mines. The output for the whole year is estimated to be approximately 380,000,000 lbs., compared with 396,852,000 lbs. in 1945. These figures, however, do not include secondary aluminum consumed by primary producers.

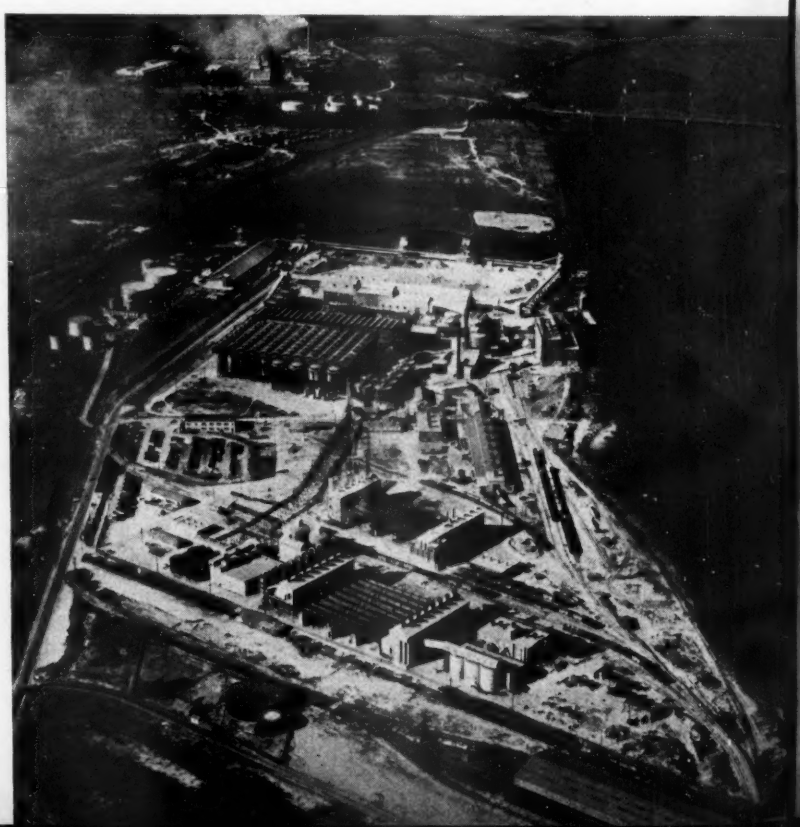
The total quantity of secondary aluminum recovered in 1946 as unalloyed metal, in alloys, and in chemical compounds is estimated at 520,000,000 lbs., compared with 596 million in 1945 and the all-time high of 651 million in 1944. The 1946 total secondary recovery is higher than that of any other year in history except the war years 1943-45, and is four times as large as that of the peak pre-war year of 1937.

During the year the use of secondary aluminum kept pace with increased demand for primary metal. At the beginning of the year there were huge wartime scrap reserves from contract terminations and wrecked and obsolete aircraft. These dwindled rapidly, however, and were relatively low by the year end. Market prices climbed during 1946 and at the end of the year some types of secondary ingot were selling for higher prices than primary ingot.

Arkansas Mines Produce Better Than 90% of Our Domestic Bauxite

Although actual figures on domestic production of crude bauxite are available only for the first half of 1946, the total output for the year is estimated at 925,000 long tons (dried equivalent), 6 per cent less than the 981,000 long tons produced in 1945. At 925,000 long tons, 1946 domestic bauxite production is at a peace-time high, the largest quantity mined prior to 1941 being 523,000 long tons in 1923.

During the first quarter of 1946, production totaled 199,059 long tons (dried equivalent). In the second quarter production rose to 257,689 long tons, a gain of 29 per cent over the preceding quarter and a quantity greater than in any quarter prior to the middle of 1941, when 275,566 long tons were produced in the third quarter. The entire production for the first half of the year totaled 456,748



Wartime demands expanded aluminum plant capacity

long tons, 12 per cent less than in the first half of 1945. Arkansas mines accounted for 96 per cent of the first quarter production and 94 per cent of the second quarter, Alabama, Georgia and Virginia together producing the remainder.

Imports of Bauxite Increase

Imports of bauxite (wet, dry or calcined, as shipped) for the first 10 months of 1946 totaled 644,808 long tons. Figures for November and December are not yet available, but based on the monthly average for the first 10 months the total 1946 imports should approximate 775,000 long tons. Using this figure, bauxite imports for 1946 were 5 per cent greater than in 1945, when imports totaled 739,000 long tons. Total imports in 1946 also exceeded those of any year in history with the exception of the war-time years 1941-43.

Of the imports for the first 10 months of the year, 608,627 long tons were from Suriname and the remaining 36,181 tons from British Guiana and Brazil. Suriname thus produced 94 per cent of the bauxite imported in the first 10 months. In 1945 Suriname accounted for 96½ per cent of the imported bauxite.

Assuming that estimates of domestic bauxite production (925,000 long tons) and imports (775,000 long tons) will closely approximate final figures, the total new supply of ore in 1946 was 1,700,000 long tons, about 1 per cent less than the 1945 total of 1,720,000 long tons. The 1946 total new supply was higher than that of any other peace-time year in history, being surpassed only by the war years 1941-1945.

Imports comprised 46 per cent of the total new supply of bauxite in 1946, compared with 43 per cent in 1945, 16 per cent in 1944, and 20 per cent in 1942-44. In the 15 years prior to the war imports comprised 54 per cent of the total new supply. During the war years, however, the relative importance of imports declined considerably due to the shortage of ships and enemy submarine activity in the Caribbean. During 1945 and 1946, the ratio of imported ores to domestic ores has been returning rapidly to the pre-war level.

Exports of bauxite in 1946 are expected to total approximately 100,000 long tons, compared with 111,908 long tons in 1945 and 132,054 in 1944. Actual exports for the first six months of the year (all to Canada) total 45,561 long tons, a decrease of 27 per cent over the same period in 1945.

Magnesium in 1946

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By L. M. OLDT
The Dow Chemical Co.

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Magnesium Hit Its Stride in 1946. Wartime Developments and Improved Alloying Methods Have Placed the Metal in a Favorable Position

THE magnesium industry made notable progress during the first postwar year, 1946, in spite of the fact that it not only faced the usual reconversion problems which confronted all business but, in addition, enjoyed the questionable distinction of being virtually a new industry, if not created by, at least vastly expanded by, the war. Furthermore, in the field of consumer goods, there were no well established markets to which to return.

This situation can be more fully appreciated when it is realized that as early as 1940 the aircraft industry consumed approximately 75 per cent of the total domestic magnesium production and by late fall of the same year was demanding almost the entire production. This condition naturally discouraged the other newly developed commercial uses for the metal and development work along commercial lines practically ceased until government restrictions on the use of magnesium were lifted late in 1944. Even then very little progress was possible until the close of the war. Other problems beclouded magnesium's horizon during the reconversion period. There was the uncertainty as to what course would be pursued in respect to operation of government-owned magnesium plants and disposition of the sizable stock piles of metal which had accumulated.

Peacetime Demands for Magnesium Have Increased

Over-expansion of the industry during the war further complicated reconversion and the establishment of a sound peacetime magnesium industry. Our total domestic production in 1939 was 6,700,000 pounds and this amount was produced by one company. During the war 13 additional magnesium metal plants were constructed. These were operated by 10 different companies and the total production capacity was increased to 586,000,000 pounds, or approximately 87 times the 1939 figure. Production soon far outstripped consumption and cut backs began in 1944 with ultimate closing of all plants, the last one ceasing operations in October, 1945. In view of the over-expanded condition of the industry, the lack of ready markets, and the existence of large government and private magnesium stockpiles, prospects for the early resumption of magnesium production were not bright. Peacetime demands for magnesium, however, expanded more rapidly than anticipated and the available surplus stocks dwindled rather rapidly. Because of this increased demand, The Dow Chemical Company reopened its Texas plant in June, 1946, and today again finds itself the sole producer of the metal, a position which it occupied from 1927 to 1940.

Shipments of cast and wrought products in 1946 amounted to approximately 15,000,000 pounds as shown in Table I. This is close to two and one-half times the total production figure for 1939, indicating a very substantial growth and being especially significant when one considers the difficulties which faced industry during this first year of readjustment. Further study of the table will show a sharp increase in shipments beginning with January over those of the

TABLE I
MONTHLY MAGNESIUM SHIPMENTS OF CAST AND WROUGHT PRODUCTS, 1945-1946 †

Month	Castings	Wrought Products	Total (Pounds)
1945			
January	10,424,000	529,000	10,953,000
February	10,366,000	571,000	10,937,000
March	12,646,000	609,000	13,255,000
April	11,903,000	554,000	12,457,000
May	12,134,000	737,000	12,871,000
June	10,565,000	583,000	11,148,000
July	9,838,000	506,000	10,344,000
August	4,960,000	531,000	5,491,000
September	169,000	316,000	485,000
October	251,000	346,000	597,000
November	236,000	353,000	589,000
December	261,000	382,000	643,000
Total	83,753,000	6,017,000	89,770,000
1946			
January	398,000	427,000	825,000
February	438,000	415,000	853,000
March	594,000	466,000	1,060,000
April	570,000	483,000	1,053,000
May	661,000	448,000	1,109,000
June	717,000	554,000	1,271,000
July	628,000	571,000	1,199,000
August	694,000	507,000	1,201,000
September	811,000	656,000	1,467,000
October	921,000	715,000	1,636,000
November	866,000*	685,000*	1,551,000*
December	866,000*	685,000*	1,551,000*
Total	8,164,000	6,612,000	14,776,000

* Estimates based on average of the last two months for which Bureau of the Census figures are available.
† All figures obtained from U. S. Bureau of the Census.

closing months of 1945, the increase over December being 53 per cent in the case of castings and 12 per cent in wrought products. Shipments of castings continued to rise each month with the exception of temporary setbacks in April and July, reaching a postwar high of 921,000 pounds in October, an increase of more than 100 per cent over January. Data for November and December are not yet available and figures shown for these months are estimates based on an average for the two previous months. It is quite likely, however, that shipments for these months will also show increases over the preceding ones. Shipments of wrought products also increased steadily during the year although the increases were not quite so substantial as those for castings. The October figure of 715,000 pounds represented a 67 per cent increase over the 427,000 pounds for January.

Expansion in Number of Fabricating Firms

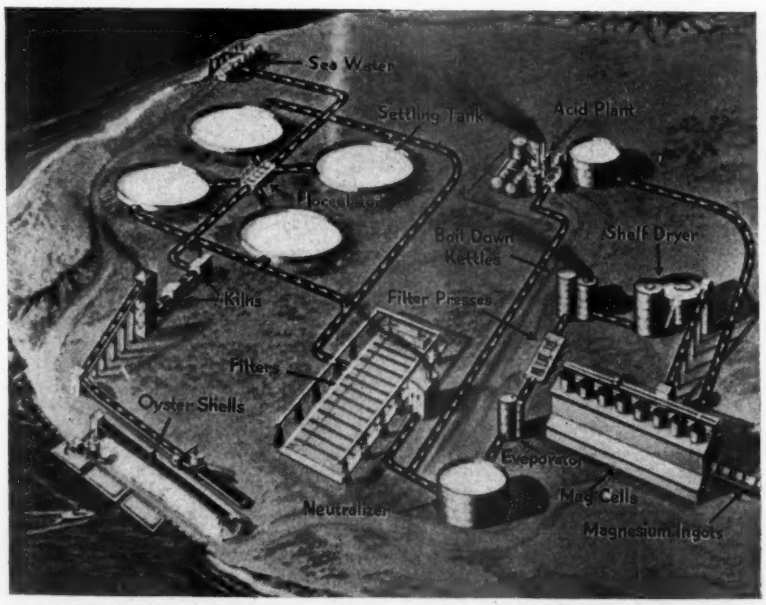
Actual production of primary metal during 1946 amounted to approximately 10,000,000 lbs. Comparative production figures for 1946 and any of the war years would be quite meaningless. However, a comparison between 1946 and 1939 shows an increase of more than 49 per cent for the year just past in spite of the fact that no metal was produced during the first half of the year. Present plans anticipate that the Texas plant of The Dow Chemical Company will realize full production early in 1947. This plant is capable of producing at least 36,000,000 pounds annually.

It is of interest to note the increase in the number of magnesium fabricators in the United States during recent years. In 1939 there were approximately 22, by 1943 the Bureau of Mines reported 85, and in 1946 the number had grown to 161. Approximately 42 per cent of these 161 firms operated fabrication and machine shops, 33 per cent made sand or permanent mold castings, 13 per cent were in the die casting business, and 12 per cent were surface treaters. This very considerable increase in the number of firms working with magnesium is indicative of the growing popularity of this new and versatile metal.

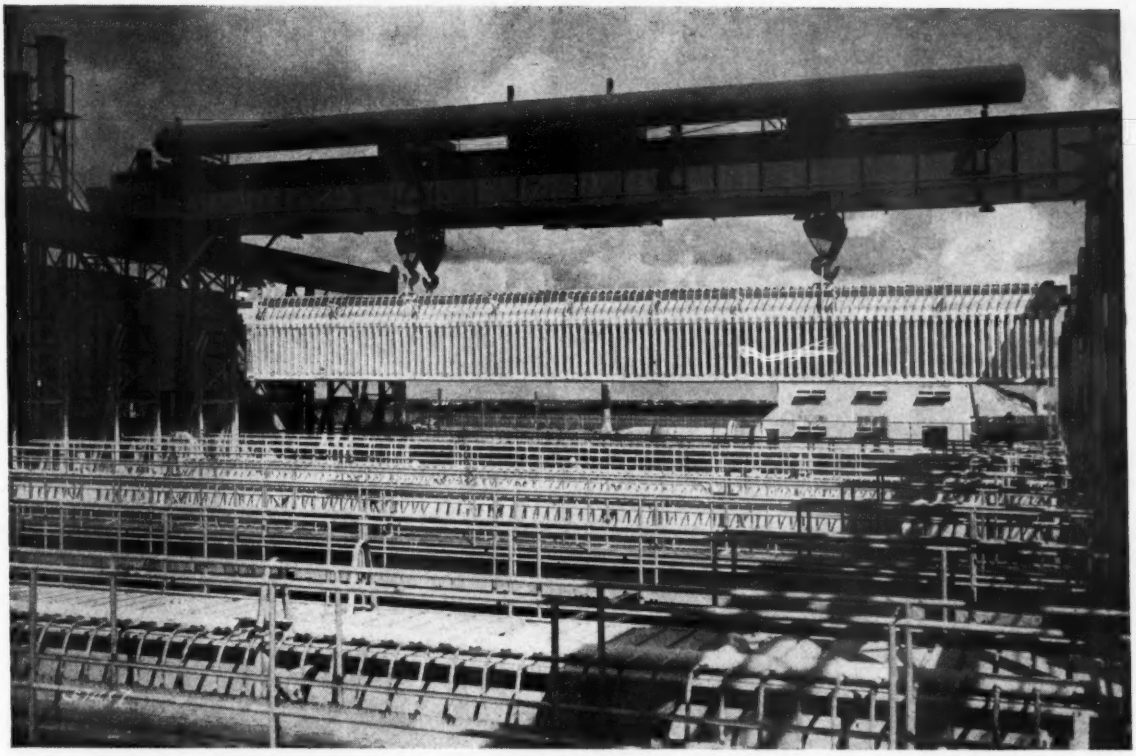
Progress was also made during the year in the technological field. It was amply demonstrated last summer, for instance, that the continuous strip and tandem mill processes, as used in the steel industry, are well adapted to the rolling of magnesium. Cast slabs of Dow FS alloy weighing 850 pounds were put through a reversing breakdown mill and rolled from 7 in. to 0.4 in. in two minutes. A minute later the metal emerged from the tandem mill as coiled 0.050 in. sheet at the rate of 1,200 feet per minute.

Magnesium Alloys Receive Attention

The never-ending research in alloy composition also bore fruit during 1946. Cerium-containing alloys were further developed for use in high tem-



Idealized diagram of the Dow process of extracting magnesium from sea water



Precipitated magnesium hydrate is filtered out from solution with Moore filters in the sea-water process

perature applications. Zirconium-containing alloys have likewise been the subject of considerable research during the past 12 months and hold interesting possibilities for those applications demanding high strength.

The problem of electroplating magnesium has long intrigued both producers and users of magnesium products and recent developments in this art give promise of soon providing an economical and decorative surface for applications where the exposure is not too severe. With more people working on metallurgical research than ever before, it is likely that developments will be forthcoming with even greater rapidity than in the past.

Attention has already been directed to the great increase in the number of magnesium fabricators and as might be expected there has been a corresponding increase in the manufacture and use of magnesium products. While there has been a steady and rapid growth in the use of magnesium in aircraft and industrial applications, perhaps the most significant increase has been in the field of consumer goods. Many products have appeared during the past year which for the first time have been fabricated from magnesium. The list includes such items as children's furniture, bathinettes, baby strollers and walkers, bicycles, carpenter's levels, canoes, ladders, combination storm and screen windows, and even pianos with a cast magnesium frame replacing the usual heavy cast iron frame.

While accurate figures as to the year's distribution of magnesium are not yet available, it is estimated that approximately two-thirds of the production found its way into industrial and consumer goods while one-third was used in aircraft applications. Present indications point to an even greater growth of the magnesium industry during the year ahead.

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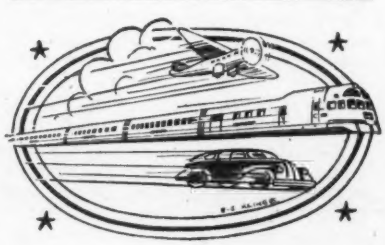
Iron Ore

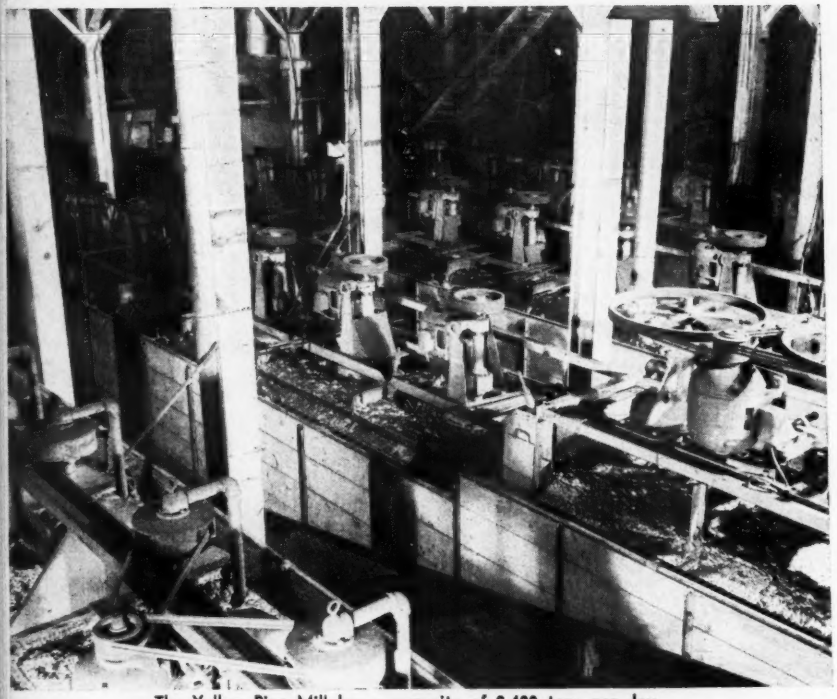
(*Continued from page 73*)

where the ore is crushed and screened into blast furnace and lump grades. The latter is washed and hand-sorted. This company is working out plans to develop extensions of the "B" orebody underground and is also planning the opening of the "A" orebody open pit.

Algoma Steel Corporation production came from the New Victoria open pit, which produced ore for sintering and for treatment in their newly-completed ferrosilicon sink-float plant. Concentrates, as well as direct ore in the form of siderites, are sintered. The old Helen Mine, a worked-out open pit, is to be reopened as an underground mine. Block caving will be used and the ore crushed and transported by belt conveyor.

The Josephine Mine produced hematite concentrates by underground stoping methods, utilizing diamond drilling of blast holes. Coarse ore was cleaned of waste by a sink-float system using a crushed sinter. Medium and fine ore was jigged to produce concentrates for the Algoma Steel Company sintering plant. Late in the season the mine encountered a cave-in of mud and silt from the old lake bottom and was closed at the end of 1946.





The Yellow Pine Mill has a capacity of 2,400 tons per day

Antimony

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By JAMES P. BRADLEY
Vice President
Bradley Mining Co.

★

More Antimony Is Being Consumed Today Than Before the War. Enormous Tonnages of Low-Grade Ore Are Available in Idaho, But Before These Deposits Can Be Worked, Some Sort of Tariff Protection Must Be Devised

THE present high price of the metal and the recent completion of the expansion program at the Yellow Pine Mine, Stibnite, Idaho, have resulted in domestic mine production of antimony currently being at the highest level in history. The Yellow Pine Mine is now producing at the rate of 6,000 tons of antimony annually from a low-grade antimony-gold ore, assaying 1.25 per cent antimony, .08 ozs. of gold, and .6 ozs. silver. During 1946 the Yellow Pine flotation mill was modernized and converted from tungsten milling to gold-antimony milling, a 300-ton-per-hour crushing plant completed and a 9½ by 12 ft. Marcy rod mill installed. These improvements have resulted in an increase of the mill capacity to approximately 2,400 tons of ore per day.

The Harshaw Chemical Company's antimony smelter at El Segundo, Calif., was enlarged during 1946 and is capable of handling about 1,000 tons of antimony concentrates (50 per cent grade) per month. This plant chiefly produces oxide and also makes some metal. It has been announced that on December 31, 1946, the National Lead Company acquired the properties of the Texas Mining & Smelting Company, of Laredo, Tex., producers of antimony metal and oxide.

Until Recently Most Antimony Came from Foreign Sources

Until the Yellow Pine Mine came into production, the domestic mine output of antimony was insignificant and consisted principally of the antimony contained in antimonial lead produced at various lead smelters. Government reports dealing with antimony indicate that domestic production is unimportant and do not reflect the recent expansion of antimony mining activity in Idaho.

Recovery from scrap (mainly from old storage batteries) has continued as one of the most important sources of antimony.

China, Bolivia and Mexico have normally been the chief sources of world supply of antimony. During recent years the production in these countries has been affected by higher costs and other difficulties due to inflation, civil wars, etc. It is reported that the RFC has purchased 3,000 tons of Chinese antimony metal to be shipped at the rate of 500 tons per month.

During World War II, Idaho mines supplied about 95 per cent of the domestic antimony production, and, at present, practically the entire domestic mine output of antimony is coming from Idaho.

The Domestic Demand Is Increasing

Since the end of 1943 there has been a deficit in the supply of new antimony in this country. This situation has been aggravated since the end of the war by the strong competition for available foreign production from European countries which were deprived of antimony during the war. The Government stockpile of antimony declined from 23,728 tons on January 1, 1944, to 4,832 tons on October 31, 1946. Antimony is one of the few metals still under Government allocation.

A report issued by the Civilian Production Administration in July, 1946,

stated that domestic requirements are increasing and will be much greater than the pre-war normal use, and may even be as great as those for the last war year. This would forecast a post-war domestic consumption of about 46,000 tons annually. The data on actual consumption is not available for per-war years. However, the apparent consumption (primary antimony available for consumption plus secondary antimony produced) during the 5-year period 1936 to 1940, inclusive, averaged about 25,000 tons per year. Based on the above figures, the Civilian Production Administration forecast indicates that post-war consumption of antimony will be 84 per cent higher than pre-war consumption.

With the exception that more antimony is now being consumed than before the war, there has not been much change in the metallic uses for antimony (antimonial lead, bearings, batteries, type metal, etc.). During World War II, a new use developed for antimony oxide for the flameproofing of textiles (tents, gun covers, etc.) and for use in fire-retardant paints. 7,675 tons of antimony went into the flameproofing of textiles during 1945 and this tonnage would have been much higher if the war had not ended in August of that year. Wartime oxide requirements were estimated at 2,500 tons per month and new plants had been built to produce antimony oxide and were just getting into operation when the war ended suddenly and the oxide contracts cancelled. The oxide program was considered so urgent during the war that practically the entire Government stockpile of antimony metal was converted to oxide. The consumption of antimony in flameproofing materials is continuing at a lesser extent during peacetime.

Domestic Production Held Back by OPA and Lack of Tariff Protection

The prices of antimony products have risen sharply since the end of the OPA. On November 9, 1946, the price of the metal, f.o.b. Laredo, Tex., was 14½c per pound, and on December 31, 1946, this price had risen to 28¼c per pound and is now in line with the world price. During the last few years the OPA ceiling on antimony was kept far below the world price, and there was no Government action (such as the Premium Price Plan for copper, lead and zinc) to compensate miners for this low ceiling.

There are enormous tonnages of low-grade antimony ore in central Idaho, and if local smelting facilities were available, many new mines could be developed. The antimony mineral in this type of ore is concentrated into a flotation concentrate, and smelters which were built to handle foreign imports in the form of crude oxide ore, cannot usually smelt such antimony flotation concentrates. Before local smelting facilities could be built, a protective tariff would be necessary. At present there is no tariff on antimony ore and concentrates, and a tariff of only 2c per pound on the metal.

Part of the Yellow Pine open pit

The Outlook for Quicksilver

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By S. H. WILLISTON
Vice President
Cordero Mining Company

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The Panoche Mine has been an important California producer

New Discoveries of High-Grade Ore Have Saved the American Quicksilver Industry Temporarily. Unfortunately, Increased Mining Costs and Foreign Competition May Ultimately Close Down Domestic Production

THE outlook for quicksilver in 1947 is dark. Surplus metal in the United States together with metal in bond, is not far from a nine month's supply at 1946 consumption rates.

Consumption of quicksilver in 1946 was somewhat above the average prewar consumption and final figures will probably indicate that slightly over 30,000 flasks were used by domestic industry during 1946. None of the war developments of mercury have as yet had any appreciable effect on the total mercury consumption. The mercury battery went into production on a small scale in the latter part of the year and while it is expected that this use of mercury will increase somewhat during 1947 it is doubtful that this will have any effect on the apparent supply and demand or on price.

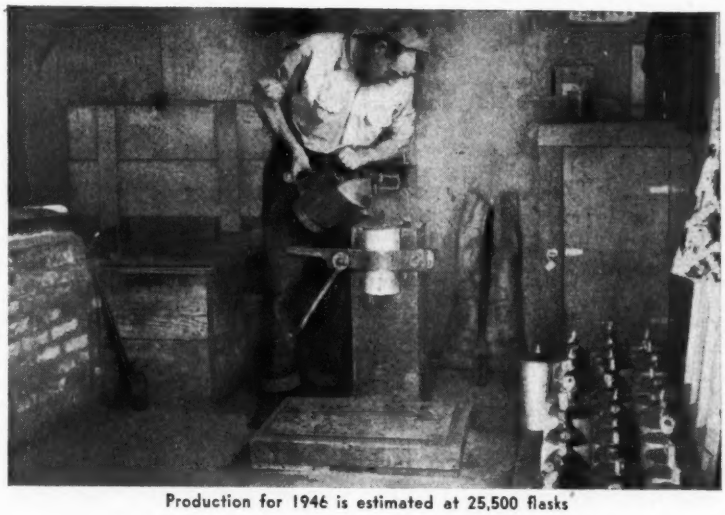
Production during the year will probably approximate 25,500 flasks and while this is the highest peacetime consumption for many years, it was derived from only a small number of mines and those numbers are steadily decreasing. At first place in the production field is the New Idria mine which produced close to one-third of the total American production. This was followed by the Cordero mine in Nevada, with slightly less than 20 per cent of the American production. The Sonoma quicksilver mine and the Reed, both located in California, each produced about 10 per cent. Only one other mine in the country, the Bonanza in Oregon, produced over 100 flasks a month average throughout the year. Thus of the total domestic production these five mines accounted for 85 per cent of the United States production and of these only two were operating at capacity as the year ended and one of these two was operating on a very narrow margin of profit.

Foreign Quicksilver Has Flooded the Market

Quicksilver prices have declined steadily through 1946. Foreign quicksilver originating in Spain, Italy, captured metal from Belgium and offerings from Yugoslavia have steadily forced down New York quotations and domestic producers had no option other than cutting prices to dispose of their product or close down. Most of the foreign metal offered might be considered distress metal as it was offered freely from excess war-produced stocks, primarily to obtain American dollar exchange presumably for food and supplies or for urgent requirements of war ravaged countries. In the latter part of the year considerable amounts of metal were shipped in from Italy as the result of wild gyrations of the Italian lira and in this case it is believed that the quicksilver was exported to a large extent as flight from the lira and had little to do with normal price economics or costs of production.

While the price of quicksilver on the New York market was falling steadily and imports were flooding in from

abroad, costs of production in the United States were rising rapidly. While the current New York price level is back to the level of prices in 1936 and 1938 and below 1937 prices, the cost of labor and supplies at the mines had risen from 40 per cent to 100 per cent with an average increase in cost of probably between 60 per cent and 70 per cent higher than before the war. It is interesting to note in this connecton that probably the current quotation for quicksilver on the New York market of $88 a flask when priced in terms of number of days labor is apparently the lowest price for quicksilver in the last 145 years. When quicksilver was selling at $25 a flask in the 1870s it would still purchase 25 days of mine labor. Even in the latter part of the 1930 depression a flask of quicksilver would purchase 10 to 12 days of mine labor. At the present wage rates one flask of quicksilver at the mine will only purchase some eight and a half days of mine labor.



Production for 1946 is estimated at 25,500 flasks

Some Domestic Quicksilver May Be Permanently Lost

If the average grades of ore mined in the western states were anything like the grades produced before the war the industry would be completely closed down. The only reason that any of the mines are able to continue to operate is the result of extensive new discoveries of large bodies of high grade ore, discovered and developed during the latter part of the war period. Increased costs and declining prices have already turned over half of these reserves from ore to waste and since they are marginal to the ores now extracted from the stopes, in all probability these reserves will be lost for all time. It is quite possible that these tonnages of low grade ore which would have been considered excellent ore before the war may total as much as the amount of quicksilver produced in the United States during the war period, an amount by the way which was sufficient to supply all the quicksilver requirements of the United States and Great Britain and a large part of the requirements of Russia. It is also interesting to note in this connection that all of the quicksilver in the United States Government stockpiles represent imports of the metal from abroad, purchased at prices well in excess of those paid domestic producers and that this surplus metal has filled the domestic stockpile past its minimum requirements. This means that while for other metals the Government stockpiles may provide a haven for excess production, insofar as quicksilver is concerned there is no market for domestic consumption except in cutthroat competition with the foreign cartels. Already the Italians have sold metal in the United States at prices sufficiently below the quoted Spanish and Italian prices so that the tariff rate of $19 a flask (unchanged since 1922) has been absorbed. The current price of quicksilver on the London market is $83.50. The current price of American quicksilver f.o.b. the mines is almost exactly the same.

If the present trend of costs, prices and cartel policy continue little hope can be held out for the continuance of this strategic industry in the United States in spite of the fact that on the basis of prewar grades of ore the industry has more flasks in reserve than at any time in 45 years.

Gold

(*Continued from page* 82)

ferson County; Jardine Mining Company, Park County; Porter Brothers, Lewis and Clark County; Anaconda Copper Mining Company, Butte; H and H Mines, Granite County; Montana Rainbow Mining Company, Lewis and Clark County; Canusco, Inc., Missoula County; Emigrant Dredging Company, Park County; Ruby Gulch Mining Company, Phillips County, and Douglas Placers, Broadwater County.

Washington—Howe Sound Company of Chelan County was the leading producer and the Knob Hill Mine in Ferry County was the only other important producer. Production fell in Washington about 6 per cent during 1946, due to decreased delivery of ores from the Howe Sound property.

Idaho—Resumption of dredging in Boise, Custer, Elmore, Idaho and Lemhi Counties largely accounted for an increase in Idaho's production of 134 per cent as compared to 1945. Placers increased from 1,769 oz. in 1945 to 20,050 oz. in 1946. Lode mines increased from 16,011 oz. in 1945 to 21,500 oz. in 1946.

Two gold-producing mines, the Yellow Pine at Stibnite and the Talache Mines, Inc., at Atlanta, and two lead-zinc producing areas account for about 50 per cent of Idaho's production. The lead-zinc areas are the Triumph property at Hailey and the Coeur d'Alene region of Northern Idaho.

Oregon—Oregon produced 113,402 oz. in 1940; 18,529 in 1946. The production in 1945 was about one-fourth of 1946 production. This is typical of the slow return of gold production to its pre-war level.

New Mexico—Production of gold in New Mexico is almost entirely derived from copper, lead and zinc mining operations in the State. Three small shipments of bullion are reported, one from Sante Fe County, one from Socorro County and one from Taos County. The Silver Creek Mining Company shipped silver-gold ores during 1946 to the El Paso smelter of the American Smelting and Refining Company.

Wyoming and Texas—No information is available on the gold production in these States, other than that Texas production consisted of 2 oz. per month for five months.

I would like to extend my thanks to Mr. Charles W. Merrill of the Bureau of Mines for assistance in securing data on the operations in the various States during the year.

Alloy Metal Ores in 1946

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By BLAIR BURWELL
Vice President
United States Vanadium Corporation

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End of War Resulted in Decreased Production of Some Alloy Metals; Demand for Others Strong Due to High Rate of Steel Production

MANGANESE and chromium alloys in 1946 continued in heavy demand paced by the rates of output of the steel industry. The increasing demand for stainless steel products resulted in capacity production of low-carbon ferrochrome. The demand for molybdenum, nickel, cobalt, tungsten and vanadium all reflected in varying degree the cessation of war consumption. Tungsten and vanadium ores and alloys in particular were affected by the ending of the war and the absorption of surplus war produced scrap and metal.

In contrast to copper, lead, and zinc, prices of alloy ores and metals have changed but little in 1946. Low-carbon ferrochrome prices have held steady throughout the year. High-carbon ferrochrome has increased 1 cent per pound. Prices of alloys of molybdenum, tungsten and vanadium have remained at substantially 1945 levels. Nickel prices were advanced at the end of the year. As the bulk of chrome and manganese ores are produced under relatively favorable labor conditions in foreign countries the cost of these ores in general have not advanced.

Production of Tungsten Declines

Of the alloy metals, tungsten has been probably the most affected by the change from war to peace time economy. From a war time peak consumption of 20,000 tons of 60 per cent WO_3 ore concentrates annually, the first three quarters of 1946 show a decline in consumption of ore to an annual rate of approximately 5,800 tons or about one-fourth of peak usage. This does not include, however, the usage of a large amount of tungsten recovered from war produced scrap and scale and tungsten metal left over from the tungsten-cored projectile program.

Imports of tungsten ore in the first three quarters of 1946 were 5,429 tons of 60 per cent WO_3 concentrates, indicating an annual total of approximately 7,000 tons. A portion of these imports resulted from the cleanup of war stimulated production at high prices in foreign countries.

The production of domestic ore declined from 1,693 tons of 60 per cent WO_3 concentrates in the first quarter to 979 tons in the second and 625 tons in the third. The projected annual production of approximately 4,000 tons was in considerable part derived from cleanup of government sponsored operations. Due to shortage of labor and other unfavorable factors the production of new mined ore dropped sharply at the end of the year. A considerable portion of the domestic output for 1946 was derived from the treatment of war accumulated material at the Salt Lake City plant of the Metals Reserve Company. This operation was finished in mid-year of 1946.

The increasing use of tungsten in metal powder, tungsten chemicals, and in high purity alloys for high temperature use requires ores of low phosphorus, molybdenum, sulphur, and arsenic content. Production figures do not show the types and quality of tungsten ore produced, but the production of high quality ores has shown a considerable decline. Prices of high grade domestic scheelite averaged about $24 per unit during 1946 compared to $22 for lower quality foreign ores at the end of the year. The increasing uses of scheelite for direct smelting has placed a premium on this type of ore.

At the end of the year the principal tungsten mines and districts in this country were either shut down or operating at a reduced capacity. Operations in the Getchell district in Nevada and Pine Creek area in California were suspended with the exception of development work. The Yellow Pine Mine in Idaho, which produced the largest part of the domestic tungsten during the war, was inactive and the Nevada Massachusetts mine in Nevada was operating at reduced capacity.

The outlook for 1947 indicates that the production of ores and concentrates will continue to decline under existing prices and costs. The demand for tungsten may improve due to the development of new uses of sintered tungsten carbide in cutting tools and greater application of high temperature alloys in gas turbines and other war developed applications.

Domestic Vanadium Production Still Exceeds Imports

Vanadium consumption in 1946 declined to a total of approximately 1,290,000 pounds of V metal in alloys and chemicals. This compares with a peak consumption of 7,262,000 pounds of V metal in 1943. Both production and consumption has shown a steady decrease since 1943. During the peak production of war time the output of vanadium from domestic mines reached and exceeded the production of vanadium in foreign countries and since the war the output from the domestic mines has continued ahead of imports. During 1946 the domestic production was approximately 1,000,000 pounds of vanadium in concentrates compared with imports estimated at 850,000 pounds. During 1946 domestic mines operated at approximately 25 per cent of plant capacity and the bulk of this production was derived from the vanadium sandstones and from carnotite ore in Colorado and Utah. The largest output came from the Rifle Plant of the United States Vanadium Corporation, which is working on a new and large ore body developed during the war period, and from vanadium produced at Monticello, Utah, by the Vanadium Corporation of America processing government stockpile ores. Operations in and around the Paradox Valley of Western Colorado were largely suspended during the year. The carnotite ores of this area were responsible for the production of the largest part of the war output. Future operations in the carnotite area will depend upon the clarification of government policy in regard to uranium source material as considerable uranium occurs with the vanadium.

Uses and consumption of vanadium alloys during 1946 show little change

over prewar years. The substitution of high molybdenum tool steel has increased the consumption of vanadium to a slight extent as the vanadium content in tool steels of this type is approximately twice that of the standard high tungsten steel. Prices remained stationary throughout 1946.

Increased Use of Cobalt for Magnetic Alloys

Compared to a total of 5,479,526 pounds of cobalt metal consumed in 1945, the first half of 1946 consumption was 1,376,804 pounds or at a rate of approximately 50 per cent of 1945 consumption. The last half of the year showed a considerable increase in the consumption and will approximate 1,900,000 pounds for a total of 3,300,000 for the year. While the use of cobalt metal declined during the year there was an increase in the use of cobalt in non metallic form for enameling, pigments and color. The use of cobalt in magnetic alloys of the alnico type, which was greatly stimulated by war demands, continued at a high level and is now the largest single outlet for metallic cobalt.

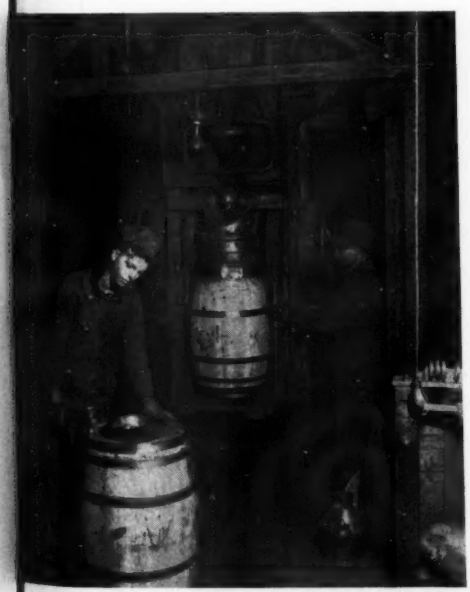
During 1946 a considerable amount of exploration and development work was carried on in the United States in search of cobalt. In Idaho the Howe Sound Company carried on extensive development work on the large copper cobalt deposits drilled by the Bureau of Mines in the early part of the war. Indications are favorable here for the development of a substantial domestic reserve. At Fredericktown, Mo., the St. Louis Smelting and Refining Company have also developed substantial reserves of complex copper-nickel-lead ore containing cobalt.

Foreign Sources Still Most Important for Chromium

During the war years, and especially in the early part when German aggression threatened African and foreign chrome ore supplies, intensive development work was undertaken in this country by the Metals Reserve Company to develop a domestic source of chromite.

Large reserves of chromite of high iron content were developed in Montana and a small tonnage was produced. However, the high iron content of Montana ores limited the use of the ores when foreign supplies of better quality were available and domestic ore production returned to prewar levels in 1946. South Africa, Russia and Turkey continue to be the principal producers of foreign chrome ore and chromite ore of extremely high quality was imported in considerable quantity from Russia during 1946.

The Philippine Islands, which produced considerable chrome immediately before the Japanese war, were inactive during 1946. Low carbon ferrochrome content was in high demand throughout the year due to the increasing use of stainless steel and prices for both the alloy and the ore held steady. The price of high carbon ferrochrome was raised 1 cent a pound at the end of the year.



Climax retains the lead as the world's principal molybdenum producer. Here molybdenum sulphide concentrate is packed at the Colorado property

Molybdenum Output Declines But Domestic Position Is Strong

The production of molybdenum ores in the United States for 1946 approximated 15,000,000 pounds of molybdenum metal compared to 30,000,801 pounds for 1945. This represents a rate of approximately 50 per cent of 1945 production and 30 per cent of peak war consumption. At the last part of 1946 consumption of molybdenum in alloy steels was increasing. Our domestic mines continued to supply the largest part of the world output of molybdenum with Climax Molybdenum retaining its lead as a principal producer. In the early part of 1946 the production of by-product molybdenum from copper operations declined sharply due to the strike at the copper mines but the large excess production capacity of the Climax Molybdenum Company in Colorado was not required to supply the total demand. The Molybdenum Corporation of America carried on mine development and diamond drilling at its Urad, Colo., property with encouraging results. A minor amount of molybdenum was produced as a by-product from tungsten mining in California. Domestic reserves of primary molybdenum ores continue to be large and adequate for future demand.

Manganese Imports Increased

As in previous years the bulk of our manganese ore in 1946 continued to be supplied from Africa, India, Russia, Brazil and Cuba with a total estimate of imports of 1,600,000 short tons. Imports in 1946 exceeded the 1,600,000 short tons imported in 1945 and 1,558,900 tons in 1944.

Domestic production will approximate 157,000 short tons, of which 7,000 tons represent battery manganese produced in Montana. Arkansas, Montana, New Mexico and Virginia are the principal domestic producing areas. As approximately 94 per cent of the consumption of manganese ore is for manganese metal and manganese alloys directly related with steel production consumption of manganese closely parallels the production of steel.

Nickel Output Less

Canada continued to supply the largest part of world output of nickel from the copper-nickel ores of the Sudbury district in Ontario. The International Nickel Co. of Canada and the Falconbridge Nickel Mines Ltd. were the principal producers. The estimated output was approximately 100,000 tons of nickel compared to 121,978 short tons in 1945. While nickel reserves in the Sudbury district continued large, considerable work was done on other types of nickel bearing ores and deposits during the year and nickel oxide production continued in Cuba from the plant of the Nicaro Nickel Co., the nickel oxide being largely used in the steel industry.

Little or no information is available as to nickel production in Russia, although mines at Petsamo were operated intensively. Production continued in New Caledonia, which was surpassed by Cuba in 1945 in volume of output, but 1946 figures are not available.

Domestic production of nickel is small and consists largely of metal recovered from metal refineries. No important domestic sources of ore were developed during the year.

Approximately 60 per cent of nickel consumed during the year went to the steel industry and the ferrous foundries. The expanding use of stainless steel consumed an increased amount of nickel.

Scrap Metals

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By

CHARLES WHITE MERRILL
Chief, Metal Economics Division

and

HERBERT L. CULLEN
NORWOOD B. MELCHER
Mineral Economists
Metal Economics Division
U. S. Bureau of Mines

★

Scrap Metal Production and Consumption Reflect the Activity of the Metals Industry as a Whole. Labor Difficulties and Low Price Ceilings Influenced the Position of Scrap on the Market in 1946, But Increased Industrial Demand Is Anticipated for 1947

SCRAP materials, both ferrous and non-ferrous, played an important role in furnishing the metals and metal products called for by industry during the reconversion year 1946.

Although full utilization of scrap was hampered by labor difficulties and low price ceilings, the contributions made by secondary metals to the over-all supply were fully as important as during the war years.

The outstanding feature in the 1946 supply of nonferrous scrap to consumers was the rising proportion of salvage scrap, which partly counterbalanced a very large decline in production scrap. Enormous quantities of production scrap had been available during 1945 when the war industries were so active. During 1946, however, manufacturers, in swinging toward full production of consumer goods, had encountered many obstacles with the result that the output of manufacturing scrap had dropped accordingly. Nevertheless, nonferrous scrap dealers kept a good volume of scrap flowing to consumers, despite the uncertainties during most of the year regarding the price structure.

Use of iron and steel scrap was lower than in any year since 1940, and consumption of nonferrous scrap, with the exception of the lead-base items, also declined. However, 1947 should be a better year for these materials, if the indicated greater industrial stability materializes from the restoration of free markets and the curtailment of Government control. On the other hand, an unresolved conflict between labor and management overhangs 1947.

Iron and Steel Scrap Inventories Declined in '46

The year 1946 witnessed a continuous decline in the available supply of ferrous scrap in spite of numerous set-backs in steel output resulting from strikes in the steel and related industries. Stocks declined without interruption during the year and, measured in terms of days of supply, reached new record lows with respect to both consumers and dealers. By the end of September inventories were scarcely adequate to last 30 days at the current rate of consumption.

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The year began with a general steel strike announced for January 14, 1946, but apparently some steelmakers hoped for a delay or cancelation. In view of this, scrap shipments were continued, and scrap men were conferring with steel officials to devise a plan whereby scrap shipments would continue to flow to consumers. However, the steel strike occurred as scheduled. Steel operations were reduced to the lowest operating rate in the history of the industry and production to the lowest level in 53 years. Iron and steel scrap was consumed at a greatly reduced rate during the first two months of 1946, although partially sustained by foundry operations. Consequently, purchased-scrap stocks accumulated to 2,829,000 gross tons at the end of March, the highest of the year. After March, purchased-scrap stocks declined until at the end of September they were the lowest recorded since the Bureau of Mines began a monthly survey of iron and steel scrap in June, 1941.

The steel strike had no more than been settled when the Nation on April 1 faced a strike by the soft-coal miners. It found the steel industry with a 40-day supply of coal, but many consumers had much smaller quantities on hand principally due to limitation of storage space. This strike resulted in a loss of more than 750,000 tons of steel ingots during April and 2 million in May. Curtailment of steel production during May caused steel producers to reduce scrap and pig-iron consumption to such a degree that the quantity of ferrous materials consumed was the smallest for any month following the steel strike. Again, at the close of the year another crippling condition overtook the steel industry, caused by a work stoppage at soft-coal mines which began at midnight (12:01 a. m.) November 21 and continued until 12:01 a. m. December 9, 1946. In addition to the approximately 400,000 miners on strike, a much larger number of other workers, many in the steel industry, were reported to have been forced into idleness.

The Six-Point Scrap Program

After settlement of the Spring coal strike, operations in the steel industry recovered rapidly, and by August production had reached a peak for the first 9 months of 1946. This level was attained by melting 8,363,000 tons of ferrous materials, of which one-half was pig iron—the highest melt for any month during the year. With this increased melt during August and the total melt in September remaining slightly above the 8-million-ton mark, iron and steel scrap supplies held by consumers were reduced to a critically low level, purchased-scrap stocks being reduced to 1,845,000 gross tons. As a result of the scrap drive inaugurated on July 15, 1946, by the Office of War Mobilization and Reconversion, consumers' receipts increased during August and although inadequate to meet requirements during September were maintained close to the August level.

To prevent possible hoarding by speculators and to assure the maximum flow of iron and steel scrap to industry through normal channels, Paul A. Porter, Office of Price Administration Administrator, announced a six-point scrap program on September 10, 1946, that kept current price ceilings unchanged, except for cast-

iron scrap. The program: (1) Established ceiling prices for the first time on sales of unprepared scrap to scrap dealers from industrial or Government sources. (2) Reduced ceiling prices on sales of unprepared scrap to consumers or their brokers 50 cents a ton, which gave dealers a differential to insure the flow of scrap through this normal channel. (3) Prohibited the purchase or sale of scrap on the condition that the buyer deliver any other commodity to the seller. (4) Prohibited sale of electric furnace and foundry grades of scrap at premium prices for use in basic open-hearth furnaces unless the scrap has been allocated by the Civilian Production Administration. (5) Provided incentive increases ranging from $2.50 to $7.00 per gross ton in the maximum prices for prepared grades of cast-iron scrap. (6) Provided for increases in the Office of Price Administration's staff of expert graders assigned to scrap and for a drive for criminal prosecution in appropriate cases of violators of Office of Price Administration scrap regulations.

The Effect of Decontrol on Scrap Was Immediate

Iron and steel scrap, as well as other scrap and metals, were restored to a free market for the first time since April 3, 1941, when President Truman abolished wartime controls effective 12:01 a. m. November 10, 1946. This action had an almost immediate effect upon the price of ferrous scrap. The price of all grades of scrap except low-phosphorous, as published by the *Iron Age*, November 14, 1946, were up $5.00 to $5.50 per gross ton. Prices of No. 1 and No. 2 Heavy-Melting steel ranged from $25.00 to $25.50 and No. 1 Cupola Cast $28.00 to $30.00. Low-phosphorous increased from $22.50 to $25.00—$25.50 on November 14—and increased again to $27.50—$28.00 by November 21.

On October 22, 1946, the Civilian Production Administration issued an amended steel order M-21 in an effort to distribute equitably the dwindling supplies of iron and steel scrap. This regulation affected both consumers and dealers and closely followed a plan approved on October 1, 1946, by the Industry Advisory Committee. For consumers, including steel mills, inventories of usable scrap, whether prepared or unprepared and including both home and purchased scrap, were limited to a 45-day supply. Because of the greater scarcity of cast scrap, stocks of this material were limited to a 30-day supply. For scrap dealers and brokers, the regulation states that scrap could not be accepted which was not to be shipped in the following 2 months. Effective on January 5, 1947, and on the fifth of each succeeding month, a dealer or broker must report to Civilian Production Administration when his shipments in the two preceding calendar months have been less than the tonnage required to be shipped to balance receipts for the third preceding month. Where such receipts and shipments do not balance as indicated above, a scrap dealer or broker must furnish the following information to the Civilian Production Administration: (1) His receipts of scrap during the past 3 calendar months, by months. (2) The reason he was unable to balance his receipts for the third preceding calendar month by his shipments during the past 2 months. (3) His current inventory. The order applies to each operating unit where a person or company maintains more than one.

Shipbreaking Program Undertaken

In an effort to increase the supply of steel scrap available to consumers, a joint shipbreaking program was undertaken by the Navy, the Maritime Commission and the War Assets Administration, and a steadily increasing number of ships were declared surplus during the year. As of September 1, approximately 15,000 tons of scrap per month were being produced from this source and estimates for November indicate a rate of 33,000 tons per month. It is estimated that shipbreaking yielded 180,000 tons by the end of 1946. Efforts were made to employ more shipyards in breaking ships. In September, 14 Maritime Commission shipyards had been made available and in October another 8 were made available by the Navy, and it was hoped another 14 would be released soon. In general, battle scrap from the Pacific area has not begun to flow to the United States, although some scrap from Hawaii is arriving. There is also some prospect of receiving scrap from Europe.

In contrast to the short scrap supply in the United States the following is quoted from *Iron and Coal Trades Review* (September 6, 1946, p. 428) which is published in London: "In these days of scarcity, it is a satisfaction to observe that steelworks and foundries experience no difficulty in obtaining adequate supplies of scrap."

Secondary Nonferrous Metals

In general, the recovery of secondary nonferrous metals from scrap in 1946 was lower than in the preceding year, as the industry struggled with problems of material shortages and labor difficulties. Lead was the only important metal of which secondary recovery was increased. Operations in the secondary lead industry were maintained at a high level throughout 1946, partly through the efforts of the Civilian Production Administration to promote the use of secondary lead and thus ameliorate the continuing shortage of primary metal.

However, the decline in the consumption of scrap for conversion to secondary metals was not apparent in the operations of non-ferrous scrap-metal dealers. Preliminery estimates indicate that total shipments of copper-, lead- and zinc-base scrap to consumers during 1946 showed definite increases over those for 1945, but dealer shipments of aluminum and nickel scrap declined. This continuance of dealer activity at a high rate, coupled with the reduced consumption of copper-base and aluminum scrap, illustrates the decline in the enormous volume of production scrap which had been available to the industry during the war years.

The supply of copper- and lead-base scrap was tight throughout the year but movement of aluminum, zinc, and nickel scrap through dealer channels was normal and the supply sufficient until close to the end of the year, when demand for aluminum scrap increased. Labor difficulties experienced by the brass mills and refined-copper producers early in 1946 did little toward alleviating the shortage of copper-base scrap, and the brass ingot makers experienced considerable difficulty in obtaining enough scrap to maintain their production at a volume equal to the demand.

Scrap Market Not Stabilized Until November

Ceiling prices of the more important nonferrous metals remained unchanged until June 3, 1946, when the Office of Price Administration partly acceded to the demands from industry by raising the price of copper from 12 cents to 14.375 cents a pound and that of lead from 6.25 to 8.25 cents a pound. During the period from July 1 to July 25, when price controls were off because of lack of legislation, primary lead producers raised the price of that commodity to 9.25 cents, but when controls were restored the price was rolled back to 8.25 cents. On October 14 an increase of 1 cent in the ceiling price of zinc was added to those previously granted in copper and lead. This brought the price of Prime Western slab zinc to 9.25 cents. On November 9, all controls on metal prices were discontinued, and producers immediately raised the prices of primary metals to the world market levels. Following each of these changes in primary metal prices, scrap prices were adjusted proportionately; how-

ever, some time was required during November for the scrap market to adjust itself to the problem of doing business without ceilings. Late that month brass mills, ingot makers, and refiners announced their buying prices for the important copper-base scrap items, and dealer buying prices were adjusted accordingly. Aluminum scrap, which had been free of price control since November 20, 1945, was in strong demand at the end of 1946, the resulting scrap price was so high that some types of secondary aluminum ingot were selling at a higher price than the corresponding grades of primary ingot.

Copper and Brass.—Owing to the substantial reduction in operations of the brass-mill industry, the total quantity of secondary copper recovered from scrap during 1946 was much less than that recovered in 1945. The reclamation of copper from scrap in refined metal, in brass and bronze as ingot, brass-mill shapes, or castings, and in other alloys and chemicals during the year was estimated to total only 750,000 tons, compared with 1,006,516 tons in 1945.

During the war years, the large quantities of new production scrap available for consumption resulted in a consumption ratio of approximately 48 per cent old copper-base scrap to 52 per cent new scrap, and the use pattern was approximately the same during the first quarter of 1946, but after that the consumption of old scrap was proportionately much larger. Final figures probably will indicate a ratio of about 54 per cent old scrap to 46 per cent new. From the point of view of the conservationist, it is the recovery of metal from old scrap that is regarded as a contribution to the available pool of metal in use. In the case of copper, the above-mentioned swing in preponderance from new scrap to old may have resulted in as large an addition to the pool as in the preceding year, even though total recovery of copper from scrap declined.

The production of brass and bronze ingot totaled approximately 328,000 short tons in 1946, compared with 378,454 tons in 1945. Due to the fact that ingot makers were unable to obtain the desired grades of scrap in the quantities needed, the production of ingot was not as high as could have been absorbed by the foundry trade. Prices for ingot, including those set as OPA ceilings, have always been based on the assumption that the greater part of the raw material used would be copper-base scrap, and ingot makers would have been unable to produce brass ingot from refined copper on account of the higher cost, even if it had been available.

Strikes Hampered Brass Production

Since many of the primary smelters and refiners of copper were closed by strikes during the early part of the year, the quantities of refined and unalloyed copper produced from scrap were lower than that in 1945. Preliminary figures indicate a total of about 78,000 tons of unalloyed copper products recovered from scrap in 1946, compared with 112,856 tons in 1945.

Brass-mill activity was severely hampered during the first half of the year by strikes that affected the larger producers, but production increased steadily toward the year-end. Total production for the brass-mill industry in October (the last month for which figures are available) was the highest of any peacetime month in history. In spite of the increased activity late in the year, recovery of secondary copper in brass-mill products was expected to total only 227,000 tons, compared with 576,115 tons in 1945. Final figures are expected to show that the other users of copper-base scrap, such as foundries, chemical plants, aluminum-ingot makers, etc., used approximately the same tonnage as in the preceding year.

Scrap-metal dealers shipped approximately 500,000 tons of copper-base scrap (the greater part of which was old scrap) to consumers during 1946, or slightly more than the 490,789 tons handled in 1945. Although dealer figures for the last months of the year are not yet complete, the indicated peak of dealer activity was in June, when 49,957 tons of copper-base scrap were shipped. This followed the price increase granted by the OPA on June 3. The fact that dealer shipments of copper base scrap during 1946 were higher than in 1945 supports the data reported by consumers, which showed that proportionately more old scrap was being used than previously. The loss in volume of copper-base scrap evidently occurred in new production scrap, a good portion of which passes directly from the producer to the consumer without entering dealer channels.

Lead.—The recovery of secondary lead from scrap gained substantially in 1946. Preliminary figures indicated a total of approximately 380,000 short tons reclaimed com-

A two-ton crane carries battery scrap to the charging floor

pared with 363,039 tons in 1945. The greater part of this increase was due to the increased smelting of battery plates and antimonial lead scrap, traceable to the marketing during the year of large tonnages of submarine-battery lead and obsolete forming-die scrap from aircraft plants.

Domestic mine production and imports of primary lead were entirely inadequate to meet the demand, and control of the metal was continued under Conservation Order M-38. The CPA, faced with the problem of equitably distributing supplies of both primary and secondary lead, found relief only in the increased production from secondary sources.

The increased smelting of battery plates resulted in consumption of approximately 310,000 tons in 1946, a gain of 10 per cent over the 279,471 tons used in 1945. Total consumption of lead scrap was approximately 485,000 tons during the year, compared with 472,495 tons in 1945. The average grade of the scrap used was apparently higher and the lead recovery better in 1946. Heavy use of drosses and residues, which are relatively low-grade, held down recovery in 1945.

Shipments of lead-base scrap and residues to consumers by scrap-metal dealers during 1946 showed a marked gain over those for the preceding year, totaling approximately 333,000 tons, compared with 304,825 tons in 1945. The greater part of this increase was apparently due to Direction 5 to Priorities Regulation 32, which prohibited scrap dealers from increasing their inventories of lead and tin scrap. However, the increase also indicates the dealers' willingness and ability to respond when a shortage of material makes cooperation and concerted action necessary.

Aluminum.—The recovery of secondary aluminum from scrap in 1946 is estimated at 260,000 short tons, a decline of approximately 13 per cent from the 298,387 tons reclaimed in 1945. The general decrease in use of aluminum scrap was evident in both the secondary ingot industry and in the operations of primary aluminum plants. Demand for scrap was steady throughout the year, and there was evidence at the close of December that reserve supplies of aluminum scrap in dealers' yards, in War Assets Administration storage depots, and on Army and Navy airfields were being reduced slowly. Production of industrial aluminum scrap was much lower during 1946 than in the war years, and both secondary-ingot makers and primary producers were forced to fall back on wrecked aircraft scrap for raw material. Production of secondary aluminum ingot during the year amounted to approximately 190,000 tons, compared with 198,426 tons in 1945. The demand for secondary aluminum ingot was steady but was not quite as strong as that for brass and bronze ingot. Toward the end of the year, secondary ingot was much easier to obtain than primary ingot, and some alloy types of secondary ingot were selling at higher prices than the corresponding prices of primary ingot. Unless reserve supplies of aluminum scrap are depleted too rapidly, secondary aluminum ingot makers will remain in a strong competitive position throughout 1947, since the full volume of primary production will be required to complete programs already under way, such as aluminum in housing. There are no evident indications that primary producers plan expansion of capacity in the near future.

The decline in consumption of aluminum scrap by primary aluminum producers resulted in a drop in the quantity of secondary aluminum recovered by those companies, which was approximately 74,000 tons in 1946, compared with 108,705 tons in the preceding year. Most of this decline was due to the fact that certain grades of foundry ingot furnished by the primary producers are made from all new metal, and the quantity of scrap consumed in the production of aluminum sheet for roofing and siding, although large, was insufficient to make up the deficit.

War-Weary Aircraft Put to Good Use

The Navy Department continued its operation of melting furnaces at certain Naval Air Stations throughout the year, in what had proved to be the most satisfactory method of disposing of wrecked and war-weary aircraft. In addition, five Army airfields full of planes were sold by the War Assets Administration to private contractors, and some of these companies planned to set up melting furnaces and manufacture ingot instead of shipping the scrap to others.

Shipments of aluminum scrap to consumers by scrap-metal dealers last year amounted to about 150,000 tons, or slightly less than 155,043 tons they shipped in 1945. The peak of dealer inventories of aluminum scrap occurred at the end of January, 1946, when 56,151 tons were on dealers' yards. It is interesting to note that dealer inventories of this material rose steadily from the beginning of the war until the end of 1944 and since has remained fairly constant near the 50,000-ton level. However, the indication is that dealers are making an effort to reduce these inventories, and the dwindling of aircraft-scrap reserves should support them in this during 1947.

Zinc.—Preliminary estimates indicate that approximately 295,000 short tons of secondary zinc was recovered in 1946, a substantial decline from the 360,444 tons recovered in 1945. Although the recovery from zinc-base scrap was only slightly less than that in the preceding year, the loss in reclamation from copper-base scrap was much more significant, being due for the most part to the reduction in brass mill operations. Final figures for 1946 should show that about 46 per cent of the secondary zinc recovered came from zinc-base scrap, whereas only 39 per cent of the total came from this source in 1945.

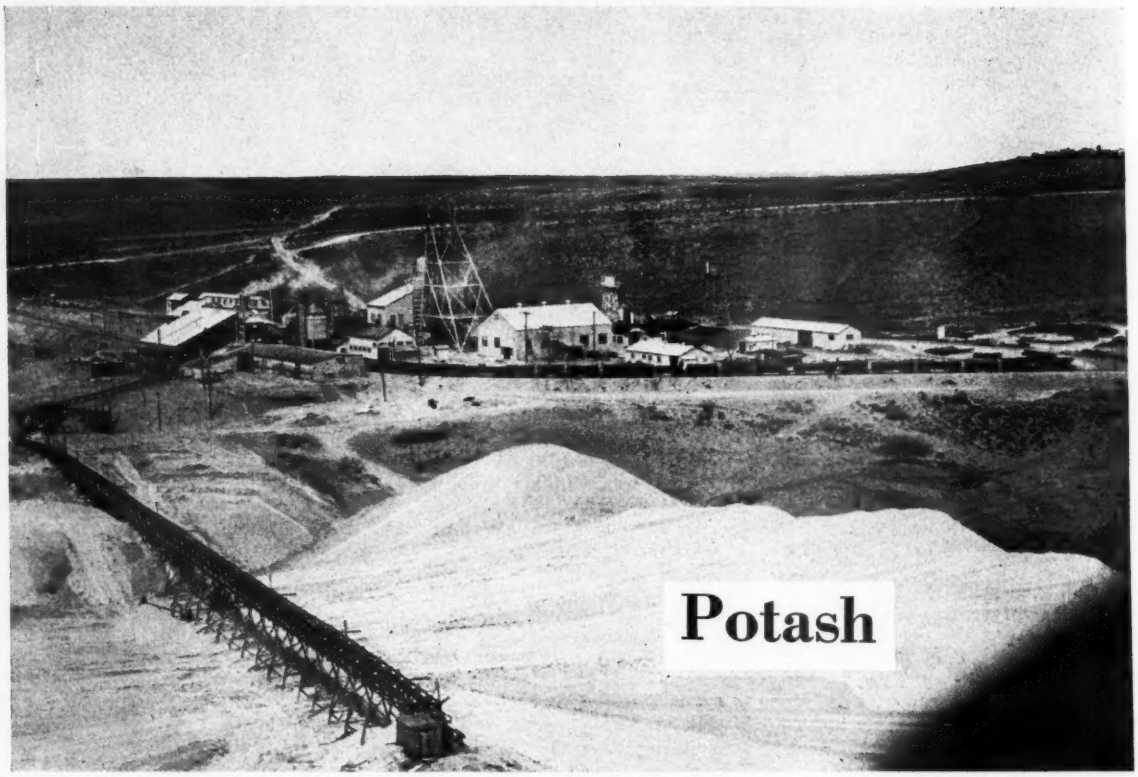
The total consumption of zinc-base scrap during the year was about 201,000 tons, a figure showing very little change from the 202,725 tons used in 1945. The one item of zinc-base scrap of which consumption increased substantially was die-cast scrap; the use of other items was about the same as, or slightly less than, in the preceding year.

Recovery of zinc from scrap by distillation was a little lower than in 1945. The secondary zinc content of zinc dust produced during the year was approximately 25,700 tons, a gain of 8 per cent over the 23,892 tons registered in 1945, whereas the secondary zinc content of redistilled slab zinc declined from 49,242 tons in 1945, to about 42,500 tons in 1946.

As has been the case in the past, most of the metallic zinc scrap was supplied to consumers by dealers, and the greater part of the drosses and residues moved directly from industrial sources to the consumers. Shipments of zinc scrap to consumers by dealers during 1946 totaled approximately 62,000 tons, compared with 56,491 tons in 1945. Analysis of the data from the dealer canvass reveals that dealer transactions in zinc-base scrap have trended upward since 1944—that being the least active year for zinc-base scrap of the 5-year period covered by the dealer surveys.

Mining Congress Journal Index 1946

Copies of the index for Volume 32, 1946, of Mining Congress Journal are available to subscribers and will be furnished upon request to this office. Following the practice of the past few years looking to the conservation of paper, no general distribution will be made.



Potash

The Industry Is Gradually Hitting Its Post-War Stride Despite "Portal-to-Portal" Pay Suits, Limitations on Prospecting and Potential Foreign Competition

By HORACE M. ALBRIGHT
President
United States Potash Co.

PRODUCTION of potash in 1946 in the United States was slightly greater than in 1945, the last year of the war, but not great enough to meet completely the requirements of the American market which traditionally includes Canada and Cuba as well as this country and its possessions.

Demand for potash by chemical manufacturers dropped early in the year, but fertilizer producers promptly bought the cancelled tonnage and sought even larger quantities to satisfy the needs of agriculture, especially in the Midwest. Government authorities continued their program of making about 20,000 tons K_2O available for export to countries outside the domestic market, that is to the West Indies, South America, New Zealand, etc. These exports were by American producers through the Potash Export Association.

While allocation of potash was discontinued on September 30, 1945, with the dissolution of the old War Production Board, the shortage in supply became so disturbing that it was deemed best to restore the controls which was done by order dated May 31, 1946. The Chemical Division of the Civilian Production Administration which supplanted the War Production Board undertook the allocation of all potash produced in the period June 1, 1946, to March 31, 1947, following the pattern used in war time, but reserving a supply for distribution to new fertilizer plants, especially in regions where potash is just being recognized as a vital plant food. As this is written, advice from Washington indicates that potash allocation will again be ended, this time as of March 31, 1947.

While production figures for the year 1946 are not yet available, a conservative estimate is that it exceeded 900,000 tons K_2O. In terms of ore mined the extraction must have exceeded 3,000,000 tons.

The principal producers are the three mining and refining companies in the New Mexico field—International Minerals and Chemical Corporation, Potash Company of America and the United States Potash Company, accounting for about 85 per cent of the total output; the American Potash and Chemical Corporation in California and Bonneville, Ltd., in Utah make muriate of potash from brines pumped from subterranean sources.

New Mexico Plants Increasing Mechanization

The New Mexico producers report that they have made improvements in plants and processes which have resulted in some additional output. Further advances in mechanization of mining have been made by each of the companies. One company en-

larged its capacity for producing run-of-mine ore for sale without refinery concentration by increasing the speed of its hoist. Impossibility of procuring materials and equipment in quantity has prevented plant (particularly refinery) expansion and all signs point to continuation of this condition in the year ahead. The labor supply in New Mexico has also been inadequate for other than normal maintenance and production operations.

The American Potash and Chemical Corporation which for several years has been under the jurisdiction of the Alien Property Custodian because of the discovery of large German holdings of the company's common stock was turned back to private control early in 1946 after public sale of the enemy-owned shares. B. R. Armour, president of Heyden Chemical Company, is now chairman of the Board of Directors and Frederic Vieweg has succeeded F. C. Baker as president. Executive offices have been moved from New York to Los Angeles.

This company has announced a program of expansion to cost $4,500,000. Increased output of borax and soda ash has been reported as the objective for the enlarged plant. Nothing has been said about more potash production. An item in the new budget sets up $300,000 for new research facilities. There is also an item of $2,000,000 for a new power plant.

Hon. Julius A. Krug, the Secretary of the Interior, and C. Girard Davidson, Assistant Secretary, inspected the mines and refineries in the New Mexico field on October 22, 1946. Although for 20 years extensive mining operations in this field have been carried on in Federal lands under leases, this was the first time a head of the Department has observed operations there.

Regulation Has Prevented Prospecting by Older Potash Companies

In recent years, potash leasing regulations have been interpreted to exclude mining operators having the maximum number of six leases from exploration activities on Federal lands. There has been no search for new ore bodies by private enterprise. In 1945 the Department itself conducted drilling operations in the New Mexico field and encountered a fair-sized body of ore, but the older mining companies have been consistently prevented from prospecting outside their leased holdings.

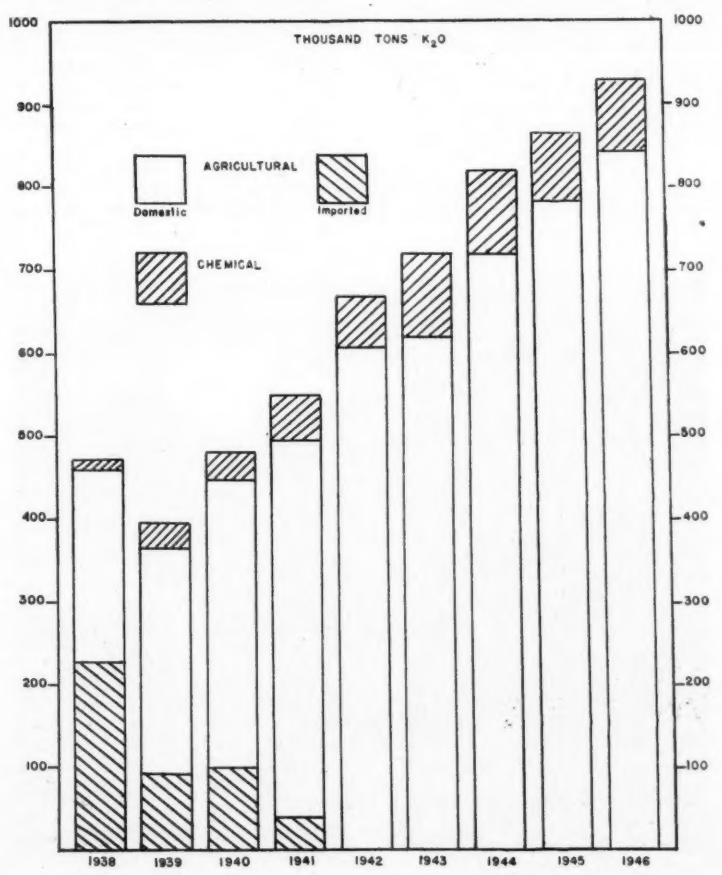
On September 25, 1946, the Under Secretary of the Interior conducted hearings at Albuquerque on the proposal of the operating companies that they be authorized to hold prospecting permits for exploration purposes in accordance with policies in effect prior to 1934. No decision has yet been made on the issues presented. Objections were also argued against the potash lease regulation that the Secretary of the Interior may on giving a year's notice take up to 25 per cent of a lessee's output at the wholesale price as determined by the said Secretary. The provision does not affect existing leases, but if included in new leases could be a very dangerous thing and is certainly not contemplated by existing law.

Outrageous Demands Presented in "Portal-to-Portal" Suits

The three New Mexico mining companies have the dubious distinction of being among the first victims of the C. I. O. "portal-to-portal" suit epidemic. Suits, involving claims that if successfully prosecuted could bring judgments of upwards of ten to fifteen million dollars were filed in October, long before the rash spread over all the United States and over all industry. The American Potash and Chemical Corporation has had a similar suit filed against it in recent weeks. No estimate of the amount of money involved in this suit against the California potash producer has yet been made public.

These suits are outrageous in their demands, involving not only alleged time spent walking to the shaft collar, to shops, changing clothes, etc., but for the bus ride between Carlsbad and the various mines, a distance of about 20 miles. The Carlsbad buses used by employes of two of the potash producers have not been owned or operated by the companies. The riding time is even claimed by men who drive their own cars to work.

Aside from these exorbitant and unwarranted travel time suits, labor relations in the potash industry have not been abnormal. Increases up to 18½ cents per hour were agreed to by union and management committees in line with the national pattern set by the President together with various "fringe" adjustments, including an increase of two cents per hour for the graveyard shift. Generally speaking the work week



Potash deliveries—agricultural and chemical, North America

has been brought back from 48 hours to the old 40-hour basis.

Potash Technicians Sent to Germany

In November the Department of Commerce organized a "team" of technicians and sent them to Germany to observe the condition of the potash industry in the various occupied zones. The men selected were Norman Into, International Minerals and Chemical Corporation; Russell Mumford, American Potash and Chemical Corporation; Malcolm McAllister of F. W. Berk & Company (managers of the Potash Export Association) and J. P. Smith of the United States Potash Company.

This group covered the American and British zones and were in Berlin, but were not admitted to the Russian zone. They will return from Europe soon and report to Washington.

At the present time, there appear no signs of early resumption of exports of potash to the United States. Need for this essential plant food in Europe, especially in the countries where it is produced, plus commitments to ship to Japan and other Oriental countries leaves no surplus for export. Plant output is still below pre-war capacity in some countries because of shortages of labor, coal, equipment and materials for repair of machinery.

Foreign Production Gradually Increasing

Reports from United States Government sources are to the effect that the French potash industry has brought its mines and refineries back to production approximately equal to the output just prior to World War II. In Spain the production appears to be somewhat higher than in the years before the beginning of the Civil War in that country. Palestine production in 1945 was slightly lower than in the previous year and no reports have been received on the output of the Dead Sea plant in 1946. No news whatever has been received regarding the operations of the Russian mines but there is advice to the effect that the Russians have restored the damaged Polish mines which now again belong to Russia since they lie east of the new Polish-White Russian boundary. Germany, always the largest producer, has certainly not approached its output of pre-war years but accurate information regarding the exact status of potash mining and refining in this divided and occupied country is not available.

The potash industry in common with others in the same general business field suffered the loss of a Government chemical expert of high intelligence, integrity and public spirit in the death of W. J. Wizeman, who

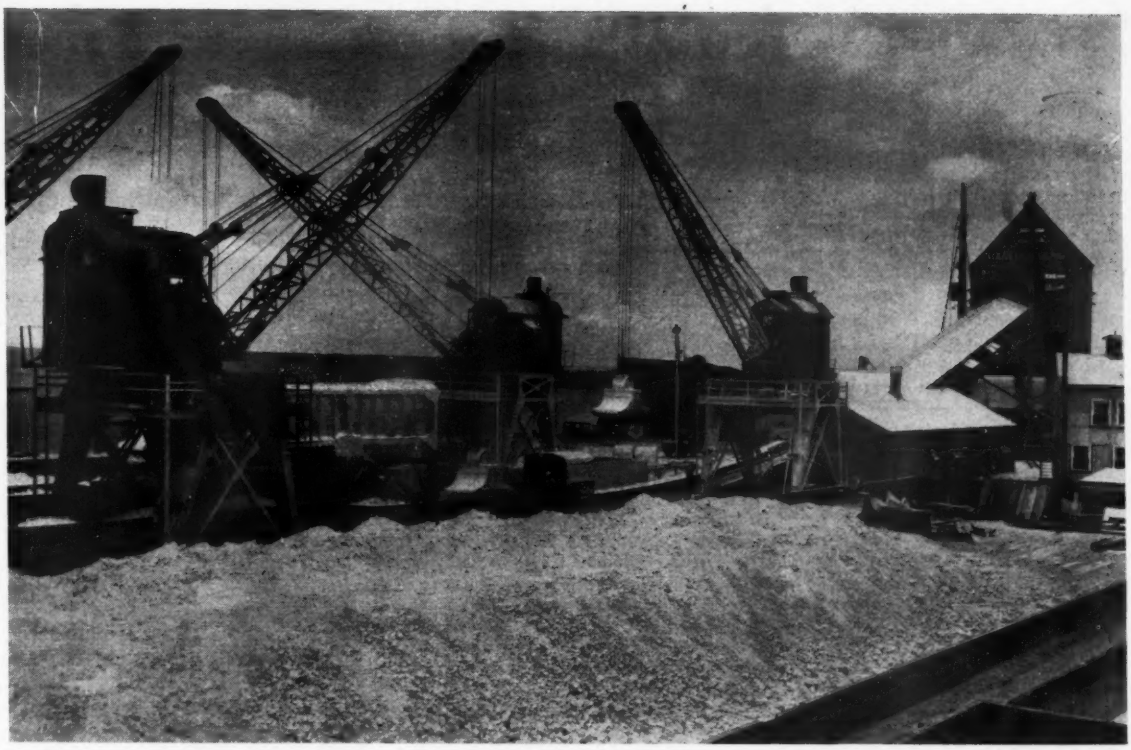
During the last 20 years domestic potash has come primarily from New Mexico. An air view of the U. S. Potash plant near Carlsbad, N. Mex.

throughout the war headed the inorganic division of the Chemical Bureau of the War Production Board. Mr. Wizeman was a staff officer of the Department of Commerce before the war and for years has been respected and admired by hosts of friends in and out of the Federal service.

The American Potash Institute, the widely known and respected agricultural research establishment maintained by three of the potash producers, continues its program of soil studies, cooperation with state and national experiment stations, fellowships and other grants all looking toward advancement of soil conservation and productivity. The Institute is also the recognized repository of statistical data on the production and use of potash.

While prices of nearly all commodities including the materials of fertilizers and fertilizers themselves have risen in the war years, potash prices are at or below the 1940 level.

Potash operations are almost entirely mechanized today



A sulfur loading plant at Galveston, Texas

Sulfur in 1946

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The Domestic Sulfur Industry Continues to Expand. Gas Treatment Methods are Improving and the Number of These Installations is Increasing

By G. W. JOSEPHSON
Assistant Chief, Nonmetal Economics Div., Bureau of Mines

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FOR the American native sulfur industry, 1946 was a record-breaking year. In the United States, manufacturers were trying to produce enough goods of all kinds to satisfy demands accumulated during the war and for this task required more sulfur than in any previous peace-time year. In addition, despite interruption of shipments to foreign countries during the maritime strike in October, exports totaled over a million long tons. The combined sales were so great that even the record production of over 3,800,000 long tons was insufficient, and about 100,000 long tons were withdrawn from producers' stocks.

This withdrawal did not reduce total producers' stocks significantly. Maintenance of large stockpiles is one of the basic rules of Frasch-process mining, because ample quantities must be on hand at all times to supply customers during possible interruptions in production, such as those caused by subsidence, loss of water through underground channels, or unexpected exhaustion of profitable reserves. At the end of 1946 stocks approximately equaled a year's sales.

High-quality native sulfur is produced at such a low cost in the United States that it has the lion's share of the domestic market, but in some localities conditions make other sources more economical. Thus we have a few mines that have pyrites as a primary product, and others that recover pyrite as a byproduct of sulfide-ore milling, a few coal washers that recover coal brasses, and recovery of sulfur compounds from various industrial gases. In the last group, the sulfuric acid obtained from sulfide-ore smelters constitutes the largest quantity.

The total sulfur recovered by gas-treatment methods is modest compared with our total production. However, the number of installations is increasing steadily, because, in addition to providing salable sulfur, they improve the quality of the gas and eliminate nuisance problems.

In addition to the native sulfur mined in Texas and Louisiana by the Frasch method, a small quantity is produced in Texas and Colorado by conventional mining methods and used for agricultural purposes.

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Last Year's Production Compared Favorably with That of 1945

Production statistics covering 1946 are available only for native sulfur produced by Frasch-type mines, but the aggregate production of all other domestic sources of sulfur probably compared favorably with that for 1945. In that year, they contributed the equivalent of about 600,000 tons of elemental sulfur—approximately 14 per cent of the total—whereas native sulfur contributed 86 per cent.

Before the war the United States usually imported 300,000 to 500,000 long tons of Spanish pyrites annually and consumed them in acid plants along the Eastern Seaboard. This trade declined to a low of 14,188 long tons in 1944, being replaced by imports of pyrite from Canada and by conversion of some acid plants to the use of native sulfur. There has been some revival of sale of Spanish pyrites in the United States (49,914 long tons were imported in January-September, 1946), but full recapture of the market is seriously hampered by shipping problems and low prices of competitive materials. Importation of Canadian pyrite is continuing; 79,187 long tons entered in January-September, 1946. This material comes from eastern Canada and serves acid plants in our Eastern States.

A small tonnage of native sulfur ore enters from Mexico for use as a soil conditioner.

In contrast with the high activity in the United States, many of the major foreign producers of sulfur operated at a low rate.

Foreign Sulfur Industry Still Retarded by Consequences of War

Before the war, mines in Sicily and on the Italian mainland exported over 200,000 long tons of native sulfur a year, mainly to European and African markets. The Italian sulfur industry has recovered in part from the complete paralysis of the time when Italy was a battle area. Operations have been retarded by shortages of fuel and supplies, but by the early part of 1946 production had been resumed at about 50 mines. However, during the past year Italian sulfur has not been moving freely into its former markets. The lira has been pegged at 225 to the dollar. Inflation within Italy has increased sulfur-production costs so that the commodity must be offered at a price of 9,500 lire per ton at Sicilian ports. Therefore Italian sulfur costs over $42 at an Italian port whereas American sulfur can be delivered to European ports for considerably less. Consequently, Italian sulfur has been accumulating in Italy. In August it was reported that 60,000 tons were in stock, and some of the mines were being forced to shut down. The Sicilian sulfur industry was in such a sad plight that special relief funds are said to have been assigned for welfare work among the miners.

The Spanish, Portuguese, Norwegian, Italian and German pyrite mines have great production capacities and for the most part were not severely damaged during the war. Even the Meggen Mine in Germany (which was developed during the war to million-ton capacity) and the various Italian mines of Montecatini that were in the battle zones were damaged comparatively little. The European pyrites mines undoubtedly will play an important part in the rehabilitation of industry in that area, but in 1946 they were restricted by the general disorganization of European economy. Production at Meggen was very small in 1946, owing to the low activity of German industry. Italian output for domestic consumption was limited by shortages of such essentials as phosphate rock for superphosphate. Norway, Spain and Portugal are normally large exporters, but under present conditions their pyrites are not moving freely. The difficulties of European trade are exemplified by an announcement that a shipment of pyrites and sulfur had been made by Italy to Czechoslovakia; in return, Italy was to receive kaolin and cellulose. Most of the trade has been on a barter basis.

As sulfur is one of the most vital industrial raw materials most governments encourage recovery from domestic deposits wherever possible. For example, during the war Argentina developed a mining operation in the Andes that in 1946 was reported to be producing at an annual rate of about 12,000 tons of native sulfur. Indications are that, despite its high cost, output was to be expanded until the country becomes self-sufficient.

On the other hand, now that sulfur is again available more freely in international trade, some countries are abandoning high-cost domestic operations. For example, the Government of India is reported to be abandoning its operations in Baluchistan, which are reported to have furnished about 66,000 tons of sulfur ore during the war.

The following are other recent developments that were of interest to sulfur producers during the past year.

The Jefferson Lake Sulphur Company began production at Long Point dome in June. Its reserves at Clemens dome are nearing exhaustion.

A unique innovation in shipping practice was started by Jefferson Lake Sulphur Co. in 1946. Ordinarily, sulfur is pumped from the wells in liquid form, solidified in the vats, broken, and shipped in solid form. Now this company is filling tank cars with molten sulfur and shipping it in liquid form to the Texas City plant of Carbide and Carbon Chemical Corporation.

The Price Remains Stable

In the United States the price of sulfur at the mine remained at $16 per long ton throughout 1946, but the export price f.o.b. vessels at Gulf ports was increased to $20 per long ton.

A recent development of the Southern Acid and Sulfur Company has been a method of recovering elemental sulfur from sour natural gas. The sulfur is removed from the natural gas as hydrogen sulfide by the Girbotol process. The hydrogen sulfide is then oxodized by the Sasco process, and sulfur is recovered. A patent covering the Sasco process was granted in 1946; it has been in commercial operation for about three years. Elemental sulfur is recovered as a valuable product and the salability of the natural gas is improved through its purification.

Sales of sulfur by American producers in foreign markets are regulated by the provisions of the Webb-Pomerene Act. During the past year the Federal Trade Commission has been investigating whether these foreign trade activities have conformed with the limitations of this law.

A novel approach to sulfur production has been reported from India. Observations of deposits of sulfur found in a low-lying coastal area of Madras, India, have led investigators to conclude that the sulfur is produced by oxidation of hydrogen sulfide derived by bacterial action on sulfates in seawater. As laboratory experiments indicate the possibility of producing considerable quantities of sulfur by this method, the Indian Institute of Science proposes to begin field trials.

The existence of several sulfur domes in the State of Veracruz, Mexico, has been known for many years. These are being explored to determine whether it may be possible to mine them by the Frasch method. If successful, this development could strongly influence the American sulfur industry.

The Phosphate Rock Industry

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This Country Has Become the World's Leading Phosphate Nation. Increased Demand Is Anticipated for 1947 and New Equipment Will Step Up Domestic Production

By BERTRAND L. JOHNSON
Mineral Economist
Nonmetal Economics Division,
Bureau of Mines

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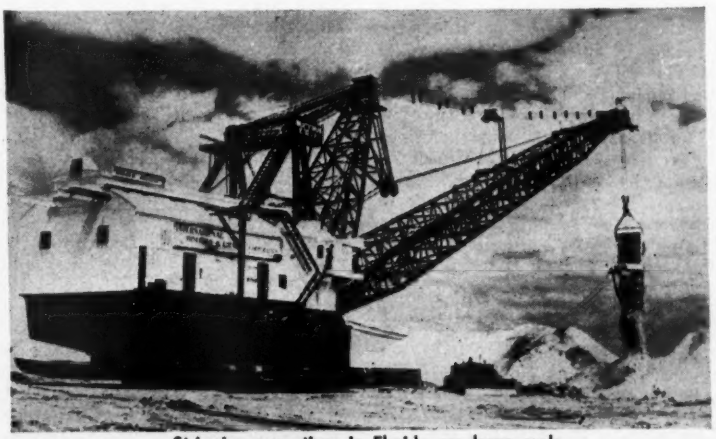
THE abnormally high demand for phosphate rock in recent years continues. Sales in 1946 appear to have made another new record, exceeding the 5,806,723 long tons of 1945. In the first half of 1946 domestic phosphate rock sold or used totaled 3,271,100 long tons, suggesting that the production for the whole year may be well over 6 million tons. Farm prices for most products reached record highs, and a new record farm income from marketing in 1946 is expected. Fertilizer consumption follows suit and, therefore, the consumption of phosphate rock. Agricultural economists expect farm income for 1947 to remain at a high level but below that of 1946. Price supports for basic farm staples have been in effect at prices equal to 90 per cent of parity, the law providing that these supports shall be effective until 2 years after the first January 1 after the ending of hostilities. On December 31, 1946, President Truman proclaimed the termination of the period of hostilities of World War II as of that date. Price support for basic commodities at 90 per cent of parity thus ends in 2 years from January 1, 1947. After that date price supports, unless previously modified, will be at much lower levels with probable lower farm incomes and smaller demand for fertilizers and phosphate rock.

Prices of phosphate rock were trending upward in 1946, the sales value increasing from $4.02 in the first half of 1945 to $4.24 in the similar period of 1946. Imports have decreased greatly during 1946. Exports are increasing, a total of 708,764 short tons being shipped abroad in the July, 1945, to June, 1946, period, compared with 489,500 long tons during the calendar year 1945.

The United States Alone Has Increased Production

World supplies of phosphate rock are sadly deficient, a shortage of some 2,000,000 tons being estimated for the year 1946-47. The Second World War disrupted both world production and international trade in phosphate rock. Of the larger producing countries, the United States alone increased its production during the war period and for the past several years has been the leading phosphate-producing country in the world. Because of domestic demands, however, it has exported annually much less than in the prewar years and therefore aggravated the foreign shortage. Increased production in other countries and greater exports from the United States were apparent in 1946. Exports from Tunisia showed substantial gains but in the first half of 1946 are reported as only 73 per cent of the prewar rate. French Morocco, however, in the first 3 months of 1946 was exporting at the rate of nearly 2½ million tons a year, much above its prewar rate, and its output was said to have been more than double that of Tunisia, formerly the leading producer in North Africa, for the same period. In the first 6 months of 1946 French Morocco exported 1,437,241 metric tons, and the 1946 yearly total is expected to reach or exceed the goal of 2,700,000 tons set for the year. In the Pacific area Christmas and Makatea Islands were reported to be shipping, and Nauru and Ocean Islands made their first postwar shipments in the latter part of 1946.

Phosphate rock in 1946 came from Florida, Tennessee, Idaho, and Montana, and apatite from Virginia. Some development work was in progress in Wyoming.



Stripping operations in Florida are large scale

Spectacular Production from Florida

In Florida, companies mining land pebble, hard-rock phosphate, and soft phosphate were active in 1946, and production is believed to have reached a new high record. In the first half of 1946 total Florida phosphate rock sold or used reached 2,351,052 long tons valued at $9,099,476, and it is expected that the production for the entire year will be at least double that figure.

The land-pebble phosphate-rock companies in operation in 1946 were the American Agricultural Chemical Co., American Cyanamid Co., Coronet Phosphate Co., Davison Chemical Corporation, operating the property of the former Southern Phosphate Co., during the latter part of the year, International Minerals & Chemical Corporation, Pembroke Chemical Corporation, Southern Phosphate (during the first part of the year), Swift & Com-

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pany Fertilizer Works, and the Virginia-Carolina Chemical Corporation.

The International Minerals & Chemical Corporation continued to operate its Peace Valley mine; it installed at this mine during the year the largest dragline excavator ever built, reported to be the largest piece of moving machinery ever assembled on land in the State of Florida. This was a huge Bucyrus-Erie walking dragline weighing 2,571,000 pounds, with a 215-foot boom and a 21.4-cubic yard bucket. The machine is supported on a circular base 51 feet in diameter, with two walking shoes 9 feet wide and 54 feet long. The 215-foot boom is said to be 35 feet longer than any ever built before. It has a reach of 218 feet and a digging depth of 130 feet and can dump its load at a height of 80 feet. Each bucket load weighs 32 tons, and the dragline can handle 60 to 75 bucketfuls, or some 4 million pounds an hour. The machine is electrically driven, with electronic controls. A stress alarm system has been installed to warn the operator of any dangerous stress at possible points of overloading. The machine both strips the overburden and mines the phosphate-rock matrix, all operations being carried on from the surface level.

At the Achan mine at Mulberry the International constructed a new plant, starting it in the spring and finishing it in August. The company will shortly open the Noralyn mine on a tract of about 1,800 acres of phosphate-rock land near Bartow.

In March, 1946, the Coronet Phosphate Company began the operation at its Hopewell, Fla., washing plant of a 150-foot-diameter hydro-separator to obtain a better separation of recoverable fine phosphate rock, ranging in size from 14- to 150-mesh, from slime rejects in present washer debris.

In August, 1946, the Davison Chemical Corporation, of Baltimore, Md., announced the acquisition of the Florida phosphate-rock mining properties of the Southern Phosphate Corporation; these properties thereafter were to be operated as the Phosphate Rock Division, Bartow, Fla., of the Davison Chemical Corporation.

In the hard-rock phosphate field C. & J. Camp and J. Buttgenbach & Co. jointly mined and shipped phosphate rock as in recent years. The Dunnellon Phosphate Mining Company shipped some wet rock, mined several years ago, from its mine near Hernando, Fla., to other mining companies.

Several soft-phosphate companies recovered phosphate rock from waste ponds in the hard-rock phosphate field, and one company mined and shipped a phosphatic clay from Bartow, Fla.

TVA Has Become an Important Source

Phosphate-rock production in Tennessee in the first half of 1946, including a small quantity of apatite from Virginia, totaled 726,149 long tons valued at $3,645,846. Both quantity and value were greater than the corresponding figures for the first half of 1945, and it is believed that the annual figures for 1946 will also exceed those of 1945. Virtually all of the Tennessee phosphate-rock production in 1946 was the "brown rock" variety, although a few tons of the so-called Tennessee "blue rock" were purchased and used by TVA; a few tons of Tennessee blue rock also were withdrawn by that organization from stock at Muscle Shoals, Ala., and consumed. Companies operating in the Tennessee phosphate-rock field in 1946 were Armour Fertilizer Works, Federal Chemical Company, Harsh Phosphate Company, Hoover & Mason Phosphate Company, International Minerals & Chemical Corporation, Monsanto Chemical Co., Tennessee Valley Authority, and the Virginia-Carolina Chemical Corporation.

The annual report of the Tennessee Valley Authority for the fiscal year ended June 30, 1946, has just been published. It states that TVA during World War II supplied more than 60 per cent of the 98,000 tons of elemental phosphorus provided the armed forces for incendiary bombs, tracer bullets, smoke screens, and for other combat purposes. Over and above military demands, TVA supplied more than 375,000 tons of phosphate and nitrate fertilizer materials to help increase wartime food production in the United States and supplied 114,000 tons of fertilizers for lend-lease and other export to our allies. TVA also produced 17,000 tons of dicalcium phosphate to help meet critical shortages of mineral feed supplements for livestock.

At the close of the war operations at the chemical plant at Muscle Shoals were directed again to the production of new and improved plant nutrients. More than 19,500 tons of elemental phosphorus were produced during the fiscal year ended June 30, 1946, and all but 2,300 tons shipped to the Chemical Warfare Service early in the year was used in producing acid for phosphatic fertilizers and animal-feed supplements. Since acid-making facilities limited output, production of phorphorus was about 66 per cent of the 1945 figure. About 68,000 tons of triple superphosphate were produced, equaling the 1939 production but below the 1940 and 1941 outputs. Difficulty in procuring proper charges for the furnaces hampered production of calcium metaphosphate, but more than 8,100 tons were produced. Production of dicalcium phosphate continued, and the output to date has totaled nearly 25,000 tons. By-products of the electric-furnace phosphorus production included 1,900 tons of potash-phosphate ash and 6,300 tons of ferrophosphorus. A small experimental plant was operated to produce a quantity of diammonium phosphate fertilizer. Experiments on a process for the production of high-grade red phosphorus were continued, and the design of a new type of acid plant to produce a superphosphoric acid (85 per cent P_2O_5) was begun. A new process for the agglomeration of phosphate fines for electric-furnace charges was also developed during the 1946 fiscal year.

The newly constructed TVA fused tricalcium phosphate plant at Columbia, Tenn., expected initially to produce about 36,000 tons per year, was placed in production early in the fiscal year and at the close of the year was capable of producing above the design capacity; more than 15,800 tons were produced.

Western States

Phosphate-rock mining operations were in progress in the Western States; shipments were made in 1946 from mines in both Idaho and Montana. Development and exploration work only is reported at the Thomas property near Cokeville, Wyo., during the early part of the year. Phosphate rock sold and used in the first 6 months of 1946 totaled 193,899 long tons valued at $1,133,329.

In Idaho both the Conda mine of the Anaconda Copper Mining Company in Caribou County and the Waterloo mine of the San Francisco Chemical Company in Montpelier Canyon, Bear Lake County, were producing, as in 1945, and a new mine was opened by the J. R. Simplot Fertilizer Company. This latter company which had operated the government-financed fertilizer plant in Pocatello, Idaho, since its erection in 1944, announced its purchase in May, 1946. This plant had obtained its phosphate rock from Caribou County, Idaho, and from near Montpelier, Bear Lake County, Idaho, and its sulfuric acid requirements normally from Garfield, Utah. In June the Simplot Co. opened a phosphate-rock mine in Bingham County, Idaho, about 20 miles northeast of Pocatello on the Fort Hall Indian Reservation in T.4S., R.37 E., Boise Meridian. The phosphate rock produced was hauled to the plant at Pocatello. This mine is expected to become a source of 72-per cent tricalcium phosphate rock much closer to the plant than the Montpelier and Conda mines, from which all phosphate rock has been obtained in the past. The Bennington

mine of the Teton Phosphate Company was reported to be idle during the first half of the year.

In Montana mining operations were reported in 1946 only in the Garrison and Philipsburg districts. The only operators were the Montana Phosphate Products Co., in the Garrison district, and the Soluble Phosphates, Ltd., in the Philipsburg district, which, however, produced and shipped a relatively small quantity. No production was reported during the first 9 months of 1946 from the Douglas Creek mine of the International Minerals & Chemical Corporation in the Philipsburg district.

In November, 1946, the United States Department of the Interior asked for bids for the privilege of developing under lease the phosphate deposits in 200 acres in Silver Bow County, Mont. These deposits are in the Melrose phosphate-rock district in T. 2S., R. 9 W. Montana Principal Meridian. The bids were opened on November 27, 1946, and the lease awarded to the highest bidder, William Anderson, of Garrison, Mont.

Various chemical firms are reported to have recently investigated the economic possibilities of the development of an elemental phosphorous industry in the intermountain area of the Western States, based on its immense phosphate-rock deposits and the availability of cheap electric power.

The production of fused phosphate-rock-olivine (or serpentine) fertilizers has begun on the west coast.

Nonmetallic Mineral Industries

The Nonmetallic Field Embraces a Variety of Products. Iodine, Quartz Crystals, Graphite and Asbestos, to List a Few, Indicate the Extent of Diversification. Industries Consuming Many of These Products Expanded During the War and Today, with a Few Exceptions, the Demands Are Continuing

By

C. L. HARNESS
Associate Mineral Economist

and

G. W. JOSEPHSON
Assistant Chief, Nonmetal Economics Div., U. S. Bureau of Mines

WHEN the Government relaxed building limitations late in 1945, the construction industry faced a demand that had accumulated through 15 years of depression and war. To supply these needs, the building-material industries, such as those producing cement, lime, gypsum, aggregates and clay products, have increased production as rapidly as possible during the past year. Virtually all of them produced more than in 1945, and some nearly attained record rates in 1946.

A high level of general industrial activity has accompanied the building boom, and consequently, with a few exceptions, production of the rest of the non-metallic minerals, including the chemical, ceramic and fertilizer raw materials, has been at high or record levels.

Of special interest to both producers and consumers of certain nonmetallics has been the establishment of a stockpile of strategic materials under the Army and Navy Munitions Board. Congress has appropriated $100,000,000 to begin a purchase program. Among the materials to be purchased are asbestos, celestite, corundum, industrial diamonds, graphite, iodine, kyanite, mica, monazite, quartz crystals, sapphire and talc.

In the space available for this review comprehensive discussion of each of the non-metallic minerals is impossible, but in the following paragraphs various noteworthy developments are outlined. Three important non-metallics, phosphate rock, potash and sulfur, are reviewed in greater detail elsewhere in this issue.

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Aggregates

The increasing demand for more fines in concrete aggregates, spearheaded by Federal specifications, is difficult for most sand and gravel producers to satisfy. A survey made by the National Sand and Gravel Association showed that over 60 per cent of a representative group of sand and gravel sources had less than 2 per cent of minus 100-mesh material in their products and 90 per cent had less than 3½ per cent. Consequently, a majority of the producers are faced with problems of redesigning their plants to increase recovery of fines or of purchasing fine sand for blending with their plant-run sand to meet specifications. There may be still another solution—air-entraining concrete. Entrained air serves much the same purpose as fine aggregate, and if experiments now in progress in various research laboratories prove that air entrainment makes high fines unnecessary aggregate producers may be saved much difficulty and expense. There is also strong promise that air entrainment will permit use of sands that have relatively poor soundness.

The trend toward greater use of light-weight aggregates continues. Much of this demand has come from the numerous block plants that have been put into operation since the Japanese surrender. In active use are bloated clay, pumice, volcanic scoria and expanded slag. Perlite is being developed by 8 or 10 companies, but only small quantities have been marketed. Methods of expanding slag have received much attention in recent months, owing to its availability in some of the areas of great demand.

Georgia supplies a fine grade of white kaolin —Courtesy U. S. Bureau of Mines

Asbestos

The established line of asbestos products enjoyed a record demand during the year. To serve this market manufacturers began to expand old plants, and a dozen or more new plants were under construction. However, the world-wide shortage of asbestos indicates that the domestic industry cannot operate at capacity for some time to come. The most acute shortage is in the grades of fiber suitable for asbestos-cement products. Greater attention is being given to recovery of very short fibers, and equipment is being installed in some plants for this purpose.

Barite

Barite production set another all-time record in 1946 of an estimated 700,000 short tons; 1945 was the previous record year. The unprecedented demand (mostly for use in drilling oil wells) encouraged producers to expand output and to install more efficient equipment.

About five or six tons of barite is customarily consumed per 1,000 ft. of high-pressure oil well drilled. This consumption rate may be cut if a method reported from California proves profitable. By centrifuging the waste mud 85 to 95 per cent of the barite is recovered as a reusable sludge. Normally this mud is discarded when its content of drill cuttings becomes too high.

Carbon Dioxide

Mark Twain's challenge has finally been accepted, and a group of practical meteorologists has done something about the weather. In Massachusetts experimenters of the General Electric Company transformed a three-mile-long cloud to snow by dropping a few pounds of dry-ice pillets through it from an airplane. Owing to the height of the cloud and the dryness of the air below it, the snow evaporated before reaching the ground. However, the method has tremendous possibilities, according to its inventors.

Cement

Air entrainment again held the spotlight in 1946. Air-entraining compounds can improve concrete, but if improperly used they may be ineffective or even injurious. There has been considerable disagreement as to where the air-entraining agent should be added—whether at the cement mill or at the mixer. Addition at the mill complicates both manufacturing and storage for the cement producer. On the other hand, the requisite technical control is generally lacking at the concrete mixer. One solution is to add the agent at the mixer on large construction projects, where close technical control is available, but add it to the cement at the mill for general use. Air-entraining cement, originally developed to decrease failure of concrete due to alternate freezing and thawing, may become the most common type of portland cement, if the predictions of some technical men are correct.

Efforts of the portland-cement industry to cut costs are emphasizing more efficient fuel utilization. The average kiln length is about 250 ft.; to conserve heat, some plants are installing 350- and 400-ft. kilns about 11 ft. in diameter. Coal saving is estimated at 25 per cent. Some companies believe they will get more ef-

fective heat transfer by decreasing the slope and increasing the r.p.m. of their kilns. At least two portland-cement companies are installing slurry filters to reduce moisture content of slurry from about 35 per cent to about 18 per cent before it is fed into the kiln as cake.

In Germany "blast furnace" cements accounted for about one-third of the total cement production during the war, and the success of this product in Europe indicates the possibility of similar acceptance in the United States. They are cheaper to make than straight portland, because 30 to 60 per cent or more of the finished cement consists of granulated blast-furnace slag ground with portland-cement clinker and a little gypsum. Its ultimate strength equals that of portland but is developed more slowly. Its slow release of heat is advantageous in heavy structures and it is particularly durable in sea water.

Clay

During the past year the competition of foreign clays has not been felt seriously by American producers. The German clays, such as Vallendar, Klingenberg and Gross-Almerode, have not been available, and the supply of English ball and china clays has been limited owing to labor and coal shortages in Cornwall. It is anticipated that these clays will be more available during 1947. However, the beneficiation of American clays is now well developed, and foreign clays are finding it increasingly difficult to compete.

Alumina from clay shows little or no peace-time promise; plants built during the war were shut down in 1946.

Diamonds

Blast holes drilled with diamond bits instead of by percussion reduced drilling costs 35 per cent at the Soudan iron mine in Minnesota. A ring-type bit with a diamond-impregnated crown is used; about 85 per cent of the crown is consumed in drilling. This cost advantage may decline, however, owing to the increasing prices of industrial diamonds.

Current methods of selecting industrial diamonds were reviewed in THE MINING JOURNAL of January 5, 1946.

Graphite

Normally, production of domestic crucible-grade graphite is negligible in peacetime, because it has been unable to compete with the large, strong Madagascar flake. However, the North American Graphite Corporation of Chester Springs, Pa., is making an effort to produce a flake that can compete successfully with foreign types.

Iodine

One of the G. I. woes during the war was the taste of water disinfected with chlorine compounds and the ever-present possibility that dormant cysts of amoebic dysentery had survived the treatment. The Quartermaster Corps has now announced that elemental iodine released in suspected water by a pill of triglycin hydroperiodide kills the cysts and is not so distasteful.

The latest edition of the *United States Pharmacopoeia* has dropped the familiar 7-per cent tincture of iodine in favor of a 2-per cent tincture, which is said to be just as efficient and reduces the danger of iodine burn.

North Carolina furnishes mica to domestic industry

Kyanite

Receipts of Indian kyanite were small in 1946, owing to production and transportation difficulties in that country, and the shortage has stimulated interest in alternative sources. The A. P. Green Firebrick Company is producing bladed kyanite in Georgia. Also in Georgia work is being done on deposits of sillimanite and massive kyanite, but there has as yet been no commercial output.

Lime

The producer contemplating building a lime plant will find two recent papers of interest. W. R. Cliffe, at a meeting of the Canadian Institute of Mining and Metallurgical Engineers in April, 1946, outlined the advantages of a rotary kiln, whereas V. J. Azbe had recommended the shaft kiln before the same group the previous year.

An inclined furnace developed by Victor J. Nelson Construction Co. has been installed at Provo, Utah, for lime burning. Great heat efficiency, low power requirement and low first cost are the advantages claimed.

Limestone fines have always been a burden around a lime plant, owing to the mechanical difficulties in calcining them, particularly in a shaft kiln. Equipment has now been developed for calcining particles as fine as 80-mesh with blasts of hot air; a pilot plant using the process is reported to be operating successfully.

Lithium

In 1946 the lithium industry was cut back far below the war-time level of production. The extensive research that has been done on lithium during the past few years has developed a number of compounds that have been offered to industry, but they have not yet found substantial markets. Four companies are selling master alloys—one is a 2-per cent lithium copper alloy for the copper and bronze field. Use of lithium in glass enamel has proved unsatisfactory to date, but lithium compounds have been used successfully in glass, glazes and low-temperature lubricants. A lithium compound extremely useful in both organic and inorganic syntheses has been reported. The new salt, lithium aluminum hydride, prepared from lithium hydride and aluminum chloride, reduces organic compounds rapidly and efficiently at room temperature.

Magnesium Compounds

Magnesium compounds from seawater and brines are becoming more important in the magnesia industry, and dolomite is becoming increasingly

prominent as a causticizing agent and enrichener for magnesium-bearing liquors. The Westvaco Chlorine Products Corporation has shut down its California mines and increased its output of sea-water magnesia. Marine Magnesium Products Corporation, South San Francisco, Calif., has erected a new unit for the recovery of magnesia from dolomite by a modification of the old Pattinson process. A new magnesia competing with dead-burned magnesite is being produced from well brines at Manistee, Mich. The sea-water plant of Permanente Metals Corporation at Moss Landing, Calif., originally designed to supply magnesia for Permanente's carbothermic magnesium metal plant, now makes both caustic and refractory grades of magnesia for a wide variety of uses.

Magnesium compounds are increasingly important as fertilizers, as evidenced by a symposium on magnesian fertilizers held by the American Chemical Society in September, 1946. Dolomite is usually used, but in recent years light-burned magnesia from Texas and California has been used on the citrus and potato crops in the East, and magnesium sulfate recovered from serpentine at a Georgia plant has found similar application.

Mica

Domestic mica production fell off sharply after the war-time Government subsidy was terminated, and interest has again centered on foreign micas and new mica substitutes. A new synthetic mica and a new mica substitute made of glass were developed in 1946. The former was a high-grade phlogopite made by the Germans by cooling slowly a melt of alumina, magnesia, silicia and potassium fluoride. Small melts were placed in a magnetic field to orient crystallization; large ones were simply lowered slowly from the furnace. The cost was about 10 times that of natural mica. A Netherlands firm reported a substitute composed of tiny glass scales held together by van der Waals' forces. The product is flexible and punchable but cannot be split. Dielectric properties vary according to the glass used. The National Bureau of Standards has developed a mechanical mica splitter which yields at least 60 splits a minute, compared to 15 a minute for hand splitting.

Monazite

Travancore, India, is normally the main source of monazite; however, in view of its content of the fissionable element, thorium, the Government of Travancore has placed an embargo on its export. American consumers of monazite, who are primarily interested in ceria and the rare earths, are in a critical position. The shortage may be relieved in part by increased production from Brazilian beach sands; a study of possible domestic sources is also being made.

Sodium Compounds

Production of natural soda ash reached an all-time high in 1946, but supply remained far behind demand. The acute shortage encouraged plans for the construction of new plants and the enlargement of old ones to recover sodium carbonates from natural sources. Westvaco Chlorine Products Corporation began sinking a well to tap the immense trona deposits at Green River, Wyo. American Potash and Chemical Co. announced plans for increasing soda ash capacity 75 per cent. The Kaiser interests are building a unit on Owens Lake in California to obtain soda ash for aluminum reduction. The West End Chemical Co., operating at Searles Lake, increased its soda ash capacity during the year.

demands from the construction industry, established a new high in 1946. After exfoliation, vermiculite in loose form is used as a heat and sound insulator in walls and ceilings and in bonded form in concrete and plaster.

Other Minerals

Sales of boron minerals are believed to have established a record in 1946, principally owing to the revival of production of enameled stoves, refrigerators and sanitary ware. Consumption in other uses was also unusually large. Many consumers of soda ash supplemented their supply of this scarce commodity with borax.

The market for quartz crystal collapsed after the war, curtailing greatly the demand for Brazilian quartz.

During the war various domestic minerals were used as substitutes for French and Danish flint pebbles and liners. The foreign flints are again being imported and are recapturing a substantial portion of their pre-war markets.

This flotation plant near Salida, Colo., produces 40-50 tons a day of ceramic grade fluorspar

Stone and Vermiculite

The crushed-stone industry expanded considerably during the year, but revival in the dimension-stone and slate industries was retarded by the limitations on construction of high-priced homes and of commercial and public buildings.

In an effort to reduce cost of dimension stone producers are trending away from the dimension-stone concept of quarrying and are progressing toward the system of processing large mill blocks through saw mills and other finishing machines.

Delayed-action blasting, in which the blasts in successive holes are separated by very small time intervals, has attracted considerable attention. Advantages claimed include better fragmentation, much less secondary drilling and blasting, and less danger of damaging adjoining properties.

Vermiculite production, spurred by

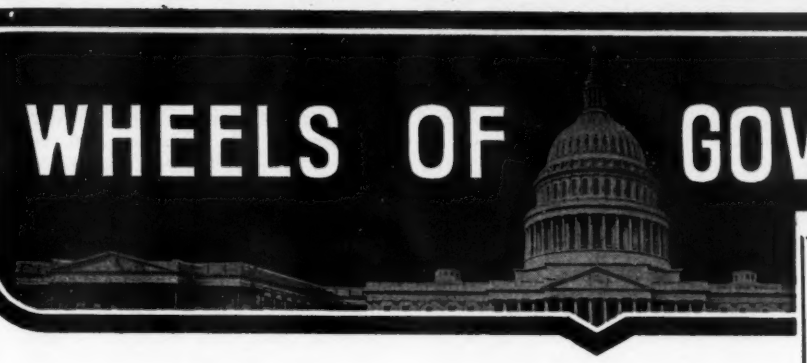
The demand for concentrated feldspars is increasing; two feldspar concentration mills were under construction in 1946.

Consumers as well as producers of fluorspar were active in prospecting and buying properties. The market for acid-grade fluorspar has held up unexpectedly well during the past year. Pennsylvania Salt Co. offered elemental fluorine in commercial quantities in 1946.

The housing boom is stimulating the growth of the gypsum industry. Much new capacity is being added and products such as insulating wallboard and waterproofed sheathing are finding use in both prefabrication and standard types of construction.

There is increasing interest in strontia for use as a ceramic flux. It is now being used for low-temperature lead-free glazes.

WHEELS OF GOVERNMENT



As Viewed by A. W. DICKINSON of the American Mining Congress

Washington Highlights

CONGRESS: Wrestling with reconversion problems.

PORTAL-TO-PORTAL: Senate subcommittee driving to report a bill.

LABOR LEGISLATION: Mining witnesses testify.

TRADE AGREEMENTS: CRI hearings end. Congress growls.

TAX: War excises continued. Individual cuts discussed.

COAL: Krug wants to return mines.

METAL PAYMENTS: OWMR takes over.

IN its first month of operation the new Congress has shown unusual speed in organizing and getting down to business on the long overdue portal-to-portal and seriously needed labor legislation, the lack of which has held back the return of the Nation to a more bountiful economy.

The President's message on the "State of the Union" was followed up with two more, one on the Budget and then the Economic Report required by the Employment Act of 1946. The Chief Executive called for appropriation of $37,528,000,000 ($1,668,000,000 more than he requested a year ago) and estimated that Federal revenue for the 1947-43 fiscal year would be $37,730,000,000. Warning against any decrease in taxation, the message anticipated a deficit of $2,293,000,000 for the current year, and the President stated, "There is no justification now for tax reduction . . . high taxes contribute to the welfare and security of the country."

The White House Economic Report called upon Congress to continue taxes at present wartime levels, increase social security benefits, raise minimum wages, broaden the coverage of the Wage-Hour law and solve the difficult labor situation through recommendations to be brought forth by creation of a 20-man commission. A long-range program was suggested to include improved industrial training; elimination of racial and religious discrimination among workmen; development of new farm markets; anti-trust enforcement and aiding small business; expansion of welfare, health and social security programs; full participation in the proposed International Trade Organization, including tariff reductions; and smoothing out high and low business cycles.

Portal-to-Portal

Senator Forrest C. Donnell's Judiciary subcommittee completed 10 days of hearings on the Capehart (Rep., Ind.) bill, S. 70, discussed in the January issue.

Emphasizing the threat of heavy damages involved in suits now aggregating more than $5 billion, Senator Capehart told the subcommittee that contemplated reconversion programs cannot go forward until the extent of this liability is known, and that the banks will proceed with utmost caution in extending normal credit and financing where the alleged liability is so great. He also warned that the potential loss in tax revenues and in increased cost of goods and services to the Government is so great that consideration of tax reductions must wait until Congress enacts legislation to remedy the portal-to-portal pay claim situation.

Among those endorsing legislative action before the subcommittee were Charles E. Hook, president, American Rolling Mill Co.; Thomas F. Patton, general counsel, Republic Steel Corp.; Raymond S. Smethurst, counsel, National Association of Manufacturers; John T. Frey, president, Metal Trades Department, AFL; Howard I. Young, president, American Zinc, Lead & Smelting Co., who appeared for his company and for the Associated Industries of Missouri; F. O. Davis, Potash Company of America; Julian D. Conover, secretary, American Mining Congress; and representatives of War, Navy, Commerce and Labor Departments.

Mr. Young stated that as the result of portal-to-portal suits his company has suddenly found itself faced with an alleged liability for amounts exceeding its entire net working capital. He asked for legislative relief through a clear definition of "work" under the Fair Labor Standards Act. He emphasized the heavy cost involved for defense of the suits as well as the additional accounting and engineering personnel required to make analyses of records, the legal expense, and interference with the work of the operating and executive staffs. He stated that unless industry is relieved of the liability imposed upon it by recent court interpretations, "We are certain to have less jobs, and for many no jobs at all. We will have many closed plants, large and small. We will have broken collective bargaining contracts and bad labor-management relations. We will have another wave of rising prices because of higher labor costs and decreased productive capacity. The Congress and the Nation face a crisis for business firms and whole industries are threatened with bankruptcy and ruination."

Mr. Davis testified on the claims against the potash companies in the Carlsbad, N. Mex., area, and stated: "There never has been any complaint by either the union or the individual employes that the services paid do not cover all activities for which the workmen were employed." Mr. Conover described the special character of the mining industry and warned of the threat, engendered by the portal-to-portal suits, to the carrying forward of badly needed exploration and development programs to replace ore bodies and mines depleted by the war. He stated that the resultant reduction in the flow of metals and minerals to industry could readily start a downward spiral of our whole economy.

War and Navy Department spokes-

men testified that travel-time claims in connection with war contracts would cost the Government $1.4 billion and that the suits could erase savings of several billions of dollars which had been accomplished through the renegotiation of war contracts.

The Judiciary subcommittee is now working to bring forth a bill for full committee and Senate floor consideration.

Rewrite Labor Legislation

Hearings opened January 23 and were scheduled to continue to around March 1 on the Ball-Taft-Smith bill, discussed last month, and other measures to bring improvement in industrial relations. Senator Taft's (Rep., Ohio) Committee on Labor and Public Welfare is hearing the testimony. Senator Ball (Rep., Minn.) in presenting his own bill before the committee emphasized that "Our approach is to eliminate or condition the special privileges and legal immunity of unions, to make their vast economic power responsible to the public interest and to prevent the monopolistic practices which are clearly harmful to the public and dangerous to freedom."

Senator Ball has introduced three additional bills, one of which would outlaw the closed shop; another would outlaw industry-wide bargaining; and a third would completely overhaul the Wagner Act. The Senator announced that he had prepared the latter bill in consultation with former NLRB Member Gerard D. Reilly, who has criticized the administration of the Act severely.

James D. Francis, president of the Island Creek Coal Co. and vice president of the American Mining Congress, appeared before Senator Taft's committee. He urged exclusion of union welfare funds from the purview of collective bargaining agreements; endorsed the Ball Bill to outlaw industry-wide bargaining; and called upon Congress to define "employe" so as to eliminate foremen, supervisors, and personnel engaged in plant protection, technical, professional, and confidential capacities from the coverage of the NLR Act. In discussing union welfare funds, Mr. Francis took the basic position that each employe "should have the free and unfettered right to dispose of his earnings as he sees fit, that any wages earned by him should be paid to him in cash unless otherwise ordered by law or assigned by him to another by his own free will and accord." An agreement to pay to the union a fund for the alleged benefit of a mass of employes, he said, "is a subterfuge and is in effect a payment to the union by the employer, and is actually taking a part of the money that would normally have been paid by the employer to the employe in the form of wages and putting it into a fund over which he has no personal direction, title or control, and no part of which may ever be used for his benefit or that of his family." Mr. Francis emphasized to the committee that welfare funds, such as that in the coal industry, give union agents tremendous power over the men they represent, and he warned that if they are imposed on industry generally, labor organizations will be enabled to dominate the economic and political life of the Nation.

Further mining witnesses will include Howard I. Young, president, American Zinc, Lead & Smelting Co., and president of the American Mining Congress, and Charles R. Kuzell, assistant general manager, Phelps-Dodge Corporation, Douglas, Ariz.

On the House side, the Committee on Education and Labor, under Chairman Fred Hartley (Rep., N. J.), has opened hearings at which testimony for the mining industry will also be given. Representative Francis Case (Rep., S. Dak.) has revised his bill of last year, which met a presidential veto in July, and there are many other pending measures. In both House and Senate bills the removal of supervisory employes from the protection of the Wagner Act is receiving pointed consideration.

Trade Agreements Hearings

The Committee for Reciprocity Information has completed hearings, which began January 13 and closed January 29, on the commodities listed by the State Department as subject to possible reductions in duty in the forthcoming negotiations with 18 foreign nations.

Appearing for copper were Sam H. Morris, chairman, Arizona Copper Tariff Board; John A. Church, representing a group of copper producers; and Representative John R. Murdock (Dem., Ariz.). Otto Herres, vice president, Combined Metals Reduction Co., and Ernest Gent, secretary, American Zinc Institute, contended against any reduction in zinc duty, and Norman Hickman, vice president, American Metals Co., asked for reduction.

Representatives of the anthracite and bituminous coal industries appealed to the committee, and aluminum metal producers and fabricators were represented by the Aluminum Company of America, Reynolds Metal Co., and others. Resisting duty reduction for the fluorspar industry were J. M. Blayney, J. G. Trewartha, Robert M. Frazer, and Thomas Bardon.

Senator Dworshak and Representative Goss of Idaho testified jointly with James Bradley, Bradley Mining Co., against reduction in the duty on antimony. Nat B. King of Laredo, Tex., likewise appeared on antimony.

The case against any duty cut on tungsten was made by Charles Segerstrom, Jr., of Sonora, Calif., James Bradley, W. Lunsford Long of Henderson, N. C., Nevada Scheelite, Inc., of Los Angeles, and the Molybdenum Corporation of America. Senators George and Russell and Representatives Brown and Camp of Georgia led the barite producers in protesting any reduction in duties on their products.

At the Capitol, particularly on the House side, feeling against the trade agreements program is increasing. House Ways and Means Committee Member Roy O. Woodruff (Rep., Mich.) has declared "there is no reciprocity to these treaties, all of us realize that they have been just a one-way street." Senator Taft of Ohio, on the other hand, is reported to have stated that the Senate majority will make no attempt to repeal the Reciprocal Trade Agreements Act, if the State Department doesn't go "too far in cutting tariffs." Senators Dworshak of Idaho and McCarren (Dem., Nev.) have introduced a resolution requesting the President and all agencies of the Federal Government to postpone any action seeking the further reduction of duties under the Reciprocal Trade Agreements Act, until sufficient time has elapsed to permit (1) a complete study by the Committee on Finance of the necessity for further action under the reciprocal trade agreements policy, and (2) action by the Congress with respect to any legislation proposed by such committee as the result of such study.

Tax Discussions

Principal tax discussions at the Capitol revolved around Ways and Means Committee Chairman Harold Knutson's proposal for a 20 per cent cut in individual income tax rates "across the board." Meanwhile, the House has acted by passing and sending to the Senate the Grant (Rep., Ind.) bill to continue excise tax rates at wartime levels. Under the President's "termination of hostilities" proclamation of December 31, these wartime rates on luxuries would have lapsed June 30, 1947.

In view of the present interest in the portal-to-portal situation, the Treasury Department has now ruled that employers who have to pay such claims "may be permitted to allocate the amounts of overtime pay and liquidated damages for prior taxable years, necessitated by the decision in *Anderson* vs. *Mt. Clemens Pottery Co.*, to the year or years in which the services to which such payments relate were rendered." The ruling continues: "For purposes of this ruling, all suits which have been filed against employers and all answers or other pleadings thereto filed by employer may be regarded as directed to the

(*Continued on page* 129)

Portal to Portal

(*Continued from page* 24)

upon bank and credit facilities and upon tax revenues, renegotiation proceedings and the Government's fiscal status, it is evident that this whole program, unless curbed, can end in economic disaster for everyone —including that segment of organized labor that is seeking these windfalls.

Suits Jeopardize Future Mineral Supply

Two further points should be brought out:

First, the great severity with which the portal-to-portal suits would bear upon the smaller mine operators. The extremely large claims now being formulated would no doubt wipe out the assets of hundreds of these smaller mines—which make up an important part of the industry, and from whose ranks some of the large mines of the future may be developed. Even the cost of defending such suits is beyond the means of many of these smaller companies. Action is needed promptly to prevent this unwarranted dissipation of their assets.

Second, a healthy and vigorous mining industry is of paramount importance to our future national security. This was demonstrated in the recent war, when despite the great variety and quantity of metals and minerals imported, our major reliance was of necessity upon production from our own mines. Drastic curtailment in programs of exploration and development of future reserves could indeed make us a "have-not" nation as to many essential minerals that we now produce, and seriously weaken our ability to defend ourselves. In the national interest Congress should take positive action to assure that this portal-to-portal program does not jeopardize our future mineral supply.

Turning now to the various proposals that have been made for meeting the portal-to-portal threat, it is our belief that the Capehart amendment to S. 70 offers the best solution of the problem.

Compensable Activities Proper Subject for Collective Bargaining

In general, it is our belief that the whole question of what constitutes work time should again be decided by the normal processes of free collective bargaining; and we are pleased to note the position taken publicly by one of the large national labor organizations, that existing agreements should be honored in good faith. In the experience of the mining industry, men on the job have always demanded pay for activities for which they thought the employer should pay; these matters have been handled promptly and satisfactorily, and the employes have shown that they are amply able to take care of themselves through established grievance and bargaining procedures. In this country the question of working time has always been a matter of bargaining between employes and employers, and it is fundamentally wrong for any branch of the Government to define work in a manner contrary to the accepted practice at the time the work is performed.

As we read the Capehart bill, it in no way precludes any employer from agreeing to pay for any of the activities that have been under discussion. Rather it specifically sanctions agreements with employes to define those activities for which payment should be made.

We do not wish to be understood as opposing any additions to the Capehart bill designed further to clarify the original intent of the Congress or to strengthen the validity of this proposed legislation under our Constitution.

Suggests Provision to Stay Costly Litigation

In the course of my testimony I have mentioned the injury to the mining industry from the mere pendency of these suits and also the cost —which bears with particular severity upon the small mine operators— of defending these suits. It is the hope of the mining industry that this committee will include in its consideration of the portal-to-portal problem, provision for staying this costly litigation. We are not suggesting that employes should be deprived of the right to test in the courts the Act as amended, but a way should be found to avoid the economic waste of a multiplicity of cases being tried at the same time while representative test cases are taken to the Supreme Court.

The epidemic of portal-to-portal suits and the uncertainties created by judicial decisions under the Fair Labor Standards Act have created a situation that calls for prompt legislative action. We trust that the Congress will exercise its powers promptly and decisively, so that the mining industry and industry in general may fulfill its duty of producing today and planning for production in the future.

ANNOUNCING

P&H's New 6-yd Electric Shovel

Now Available with "Magnetorque" Hoist Drive

Magnetorque Drive simplifies the entire hoisting machinery including the power units . . . a simple AC induction motor does the driving.

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ELECTRICAL EQUIPMENT—all designed specifically for shovel service — not adapted for it.

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Personals

Callahan Zinc-Lead Company has announced the election of **R. F. Mahoney** as vice president and director, as of January 1, 1947. Mr. Mahoney has been superintendent of Sunshine Mining Company and leaves the company after 12 years of service. His new duties will embrace supervision of operations, development, and exploration activities for the Callahan Zinc-Lead Company.

H. Lionel Kringel has retired as president, director and chairman of the Pennsylvania Coal and Coke Corporation, but will continue in an advisory capacity, it was announced early in January following a board meeting. He will be succeeded as president by **Joseph T. Berta**, who has been with the Philadelphia & Reading Coal and Iron Corporation since 1928.

C. Prevost Boyce, senior partner in Stein Brothers and Boyce, has been made chairman of the board and **John S. Routh**, president of the Routh Coal Corporation, has been elected a director.

Announcement has been made of the retirement February 1 of **C. A. Schmidt**, since 1914 superintendent of operations of the Empire Zinc Company, at Hanover, N. Mex. Mr. Schmidt has completed a long career with this company and for many years has been among New Mexico's most prominent and active mining engineers and executives. His future plans are indefinite, but he and Mrs. Schmidt plan an extended sojourn in California.

Frank Smith has been appointed superintendent of the Leatherwood mine of the Blue Diamond Coal Co. in Kentucky. He was formerly superintendent of the Keen Mountain mine of the Red Jacket Coal Corp. in Virginia.

H. J. French has been appointed assistant vice president of The International Nickel Company of Canada, Limited, Robert C. Stanley, chairman and president, announced. Since September, 1943, Mr. French has been assistant manager of the Development and Research Division of International Nickel. Previously, and for a period of 12 years, he was in charge of Alloy Steel Development. Mr. French joined International Nickel in 1929 as a member of its Research Laboratories in Bayonne, N. J.

Joseph H. Kerrick, formerly fuel engineer, Philadelphia & Reading Coal & Iron Company, has been made manager of the Berks Building Block Corporation, Reading, Pa.

A. C. Harding terminated nine years employment with the Baroid Sales Division, National Lead Company, when he resigned as general

superintendent the first of the year. He is now at Moorcroft, Wyo., where he is organizing a new bentonite company to build and operate a plant on the west edge of the Black Hills bentonite district.

C. M. Harrer, mining engineer, who has been on The M. A. Hanna Co. iron ore exploration in Brazil, has returned to his position as engineer for the Ozark Ore Co., a Hanna iron ore subsidiary at Iron Mountain, Mo.

Charles J. Golden was recently appointed division engineer for the Hudson Coal Co. Formerly assistant division engineer of the Delaware and Pine Ridge Collieries, Golden will replace the late Howard M. Girton.

Neil R. Allen, of Grants Pass, Oreg., has been elected to head the governing board of the Oregon State Department of Geology and Mineral Industries.

Harold Maryott, formerly chief mining engineer with the Miami Copper Company, is now general superintendent of the Comstock Extension Mining Company, Globe, Ariz.

E. R. Cooper, formerly with Island Creek Coal Co., has been made manager of coal mines for the Jones & Laughlin Steel Corporation. He had been general superintendent and is succeeded in that post by **W. E. Hess**. Jones & Laughlin has also named **H. K. Griffith** as assistant to manager of coal mines.

J. E. Hayes, who has been associated with the New Jersey Zinc Company since 1910, retired as chairman of the board of directors recently. He has held many important positions with the company, including those of general manager, vice president, director, president and chairman of the board.

Charles E. Yates, Walter A. Kellet and **Margaretta Henning** have been granted a charter to operate a strip mine under the name of the Yates Coal Company, at Ashland, Ky.

International Smelting and Refining Company has announced that **Blair L. Sackett** will replace the late A. B. Young as metallurgical manager at Salt Lake City. Mr. Sackett was formerly general superintendent at the Tooele Plant. His position will be taken by **Carlos Bardwell** who was promoted from assistant general superintendent to general superintendent at Tooele. **W. J. McKenna** will take Mr. Bardwell's place as assistant general superintendent.

R. R. Bowie, of the Bowie Coal Company at Grove City, Pa., was recently elected chairman of the board of the Mineral Producers Association in Pittsburgh.

An announcement was made recently by F. S. Mulock, vice president and general manager of western operations of the United States Smelting, Refining & Mining Co., that **Ralph Tuck** has been appointed geologist in charge of the western exploration for the company. For three years Mr. Tuck was geologist with the U. S. Smelting Company stationed at Fairbanks and Nome, Alaska, and for the last six years he has been on the exploration staff of the company in western states, stationed at Silver City, N. Mex.

Ralph A. Lambert has been elected vice president of the Pennsylvania Coal Co. Since 1943 he has been general manager of the company and he will continue in this position.

C. M. Donahue has been appointed manager of the Mining Department of Mine Safety Appliances Company. Since 1927 he has been associated in several important capacities with this company: first, in 1927, as district

representative of the Buffalo office; 1928, assistant sales manager; 1933, assistant manager of the Mining Department; and in 1946, manager of the Sales Engineering and Planning Department. Mr. Donahue is a native of Audenried, Pa., in the anthracite region, and is a graduate of Penn State College.

Mark L. Gerstle resigned as president of the Junction City Gold Mines, Inc., at a recent meeting held in San Francisco, company headquarters.

Harry G. Lovelace has been appointed mining engineer for the Kentucky Department of Mines with headquarters at Lexington. He was formerly manager of mines for the Carrs Fork Coal Co., Inc., at Crummies, Ky.

Dean A. Irving Levorsen of the School of Mineral Sciences, Stanford University, was recently elected president of the Geological Society of America. He succeeds **Dr. Norman S. Bowen** of the University of Chicago.

Pittsburgh Coke and Chemical Company has made **Frederick D. Schreiber** manager of the coal chemicals division. He will be succeeded as general superintendent of the Neville Island plant by **John R. Comstock.**

John Edgar, Kellogg, Idaho, has been appointed general mine superintendent of the Sunshine operations in the Coeur d'Alene mining district. For the past 10 years Edgar has been chief engineer for the company. He succeeds R. F. Mahoney, who, as previously mentioned in these columns, has been appointed vice president in charge of operations for the Callahan Zinc-Lead Co.

Julius E. Graf has been named chief engineer of Jones & Laughlin Steel Corporation, succeeding **C. W. Littler**, resigned.

A. J. Alexander, president of a Charleston coal and lumber company and formerly with the Island Creek Coal Co., was named chief of the West Virginia Mining Department early in January. Mr. Alexander succeeds **G. R. Spindler**, who resigned at the end of 1946 as chief of the department to accept a position with the Joy Manufacturing Co. at Pittsburgh, Pa.

R. R. Weideman, former superintendent and engineer for the National Mining and Milling Company of Solvang, in Santa Barbara County, Calif., has accepted the position of mining engineer with the Silver Dollar Mining Co., of Wallace, Idaho.

Francis J. Kennerley was elected to the board of directors of Hercules Powder Company at a directors' meeting on January 29. Mr. Kennerley, treasurer of the company since March, 1943, will continue to serve in that capacity. His election to the board fills the vacancy caused by the recent retirement of **Luke H. Sperry.**

Harry A. Sutter has returned to his former post as vice president of the Western Pennsylvania Coal Operators Association, of Pittsburgh. He was formerly area distributor for the Solid Fuels Administration. His successor is **Francis Y. Casey**, of Philadelphia.

— *Obituaries* —

R. J. Oldham, of Centralia, Ill., died late in December of coronary thrombosis. Mr. Oldham was mine super-

intendent of the Centralia Coal Company for 31 years. He had retired a few years ago because of ill health.

Francis William Maclennan, 70, vice president and consulting engineer of the Miami Copper Company, died in Los Angeles on January 25. A graduate of McGill University in 1900, he also attended Liege University in Belgium. During the early part of his career he worked as a mining engineer in British Columbia, Utah and Nevada, and became general superintendent of the Cerro de Pasco Copper mines in Peru in 1907. Joining the Miami Copper Company 35 years ago, in 1919 he became general manager in charge of operations at Miami, Ariz. In 1937 he was elected vice president and served in that post and also as consulting engineer until his death. He was also vice president and consulting engineer of Miami Copper Company's subsidiary new open pit operation, Castle Dome Company, Inc., since its organization in 1941. Mr. Maclennan was best known in mining through his pioneer work in block caving of low-grade copper deposits. He made numerous contributions in mining methods and also in metallurgy, particularly in the fields of milling and leaching. In 1931 Maclennan received the William Lawrence Saunders Gold Medal of the American Institute of Mining and Metallurgical Engineers, for distinguished achievement in developing the mining of low-grade copper ores.

Professor Bancroft Gore, formerly on the staff of the Montana School of Mines and later manager of a copper smelter in Chile, died in Rapid City, S. Dak., in December. He was on the staff of the South Dakota School of Mines for the past 25 years.

J. Arthur Houle, well known in Arizona copper mining circles, died recently in Tucson, Ariz. He was born in Michigamme, Mich., in 1877. A graduate of the Michigan School of Mining and Technology at Houghton, class of 1899, Mr. Houle first went with the Old Dominion Copper Co. at Globe, Ariz., and later was appointed superintendent of the Calumet & Arizona smelter at Douglas. In 1912 he went with the Shattuck Denn Mining Corp., and was superintendent at the original Shattuck mine in Bisbee. He retired from active service with the company in 1925 but was retained in a consulting capacity.

R. W. Wilson of the Wood Preserving Division of Koppers Co., Inc., Marietta, Ohio, died suddenly on February 7. He became ill the previous day enroute home from his office, and died without regaining consciousness. Mr. Wilson was well known in coal circles and was a member of the Coal Division Roof Committee, American Mining Congress.

John J. McDonald, manager of Phelps Dodge Mercantile Company, Bisbee, Ariz., son of John McDonald, who first brought block-caving mining to Utah and the West, died at Bisbee in January at the age of 43.

Homer L. Williams, for many years mine manager for the Tonopah Extension Mining Co. at Tonopah and White Caps Gold Mining Co. at Manhattan, Nev., died recently in a California hospital at the age of 59 years. As engineer and mine manager he had been a leading figure in southern Nevada mining for many years.

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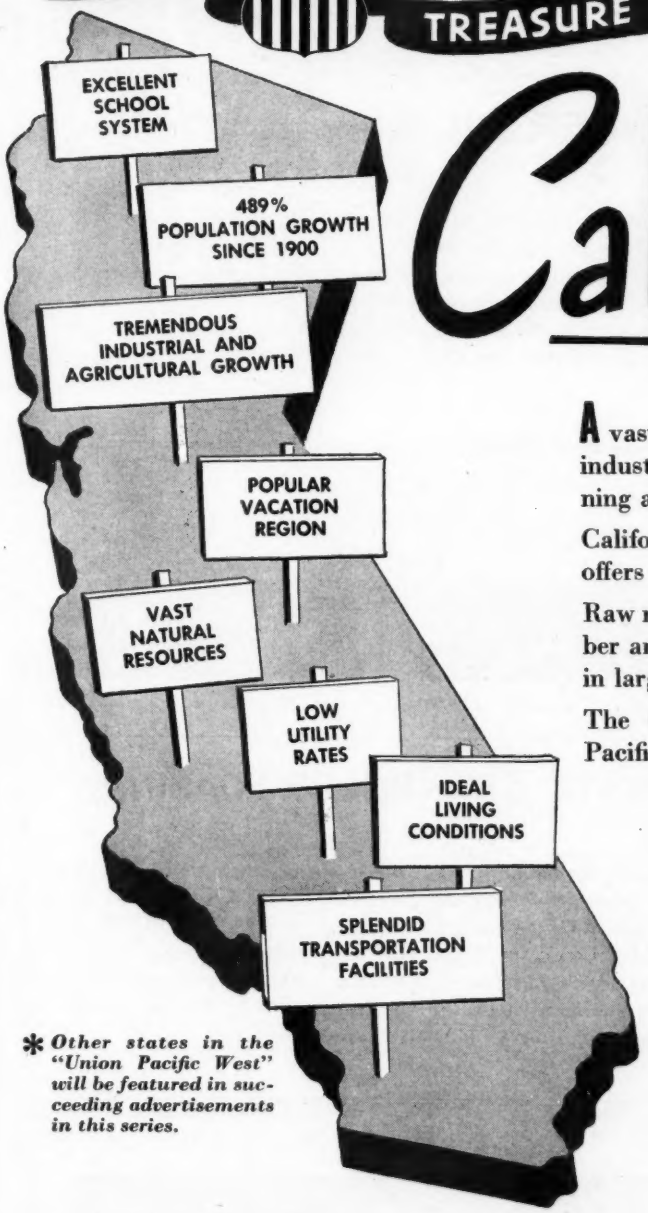
TREASURE MAP OF INDUSTRY

California*



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California's population, steadily increasing, offers a tremendous easy-to-reach market.

Raw materials . . . minerals, petroleum, lumber and agricultural products are available in large quantities.

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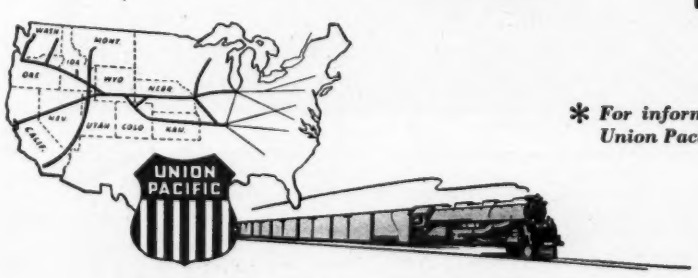

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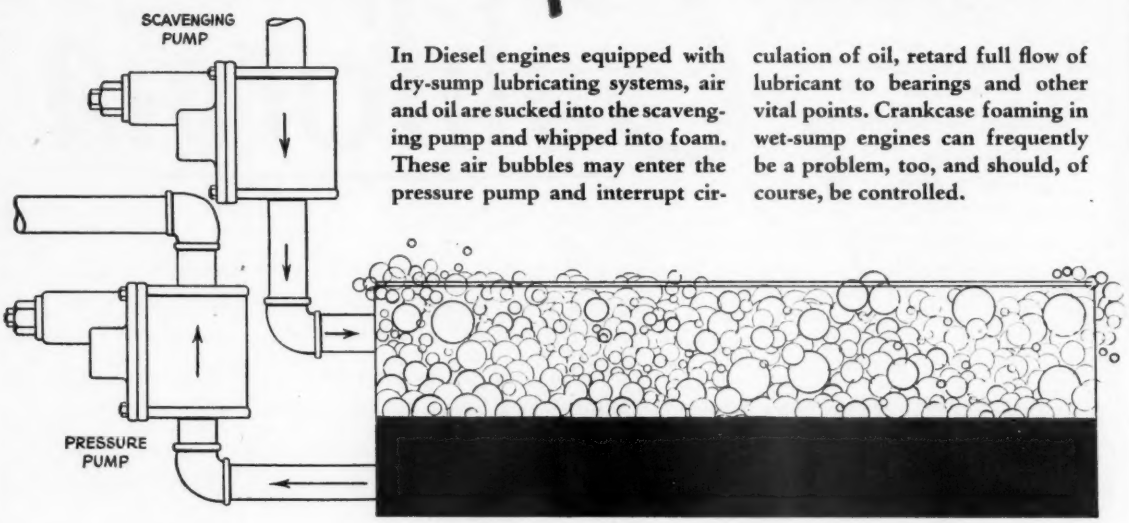
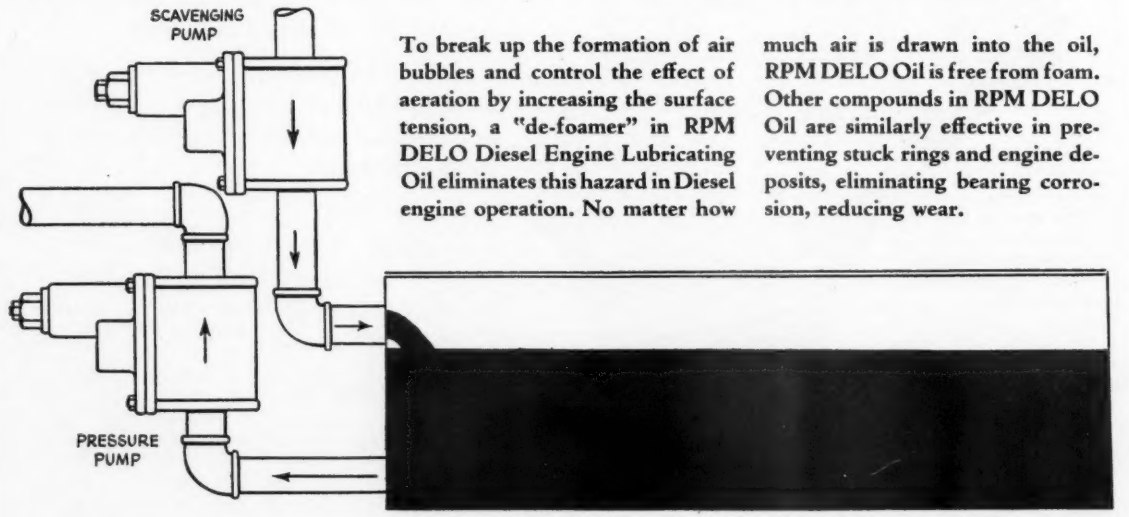


In Diesel engines equipped with dry-sump lubricating systems, air and oil are sucked into the scavenging pump and whipped into foam. These air bubbles may enter the pressure pump and interrupt circulation of oil, retard full flow of lubricant to bearings and other vital points. Crankcase foaming in wet-sump engines can frequently be a problem, too, and should, of course, be controlled.

RPM DELO OIL PREVENTS CRANKCASE FOAMING



To break up the formation of air bubbles and control the effect of aeration by increasing the surface tension, a "de-foamer" in RPM DELO Diesel Engine Lubricating Oil eliminates this hazard in Diesel engine operation. No matter how much air is drawn into the oil, RPM DELO Oil is free from foam. Other compounds in RPM DELO Oil are similarly effective in preventing stuck rings and engine deposits, eliminating bearing corrosion, reducing wear.

To match the fine performance of RPM DELO OIL, use these equally efficient companion products from the same famous "RPM" line—RPM HEAVY DUTY MOTOR OIL —RPM COMPOUNDED MOTOR OIL—RPM GEAR OILS AND LUBRICANTS—RPM GREASES. For additional information or name of your distributor, write any of the companies below:

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DIESEL ENGINE RPM DELO LUBRICATING OIL

NEWS and VIEWS

In final stage of building process, before being shaped, Tire-builder Eugene Pinkston is trimming sidewall of 27.00-33 earth-mover, largest truck tire ever built by the Goodyear Tire & Rubber Company. Weight of the tire is 1,482 pounds.

Eastern States

Exploration Begun on New Coal Tract

The Lorado Coal Mining Co. in West Virginia is exploring a new tract extending into Boone county, not far from its present No. 2 mine. Surveys were begun in September after the construction of a road. No. 2 mine has produced in the 30 years of its existence approximately 13,000,000 tons of coal and reserves are running low. The life expectancy of No. 2 does not exceed 45 years. If the results of the new prospecting are favorable a new opening will be developed on the Boone county property and coal will be transported to the present preparation plant.

Research Program Established at M.I.T.

Establishment by Armour & Company of a fund of $12,000 for a graduate research program in the fundamentals of mineral flotation at the Massachusetts Institute of Technology, has been announced.

This program, which provides for grants-in-aid for several assistantships and fellowships, will concentrate on the operation of cationic collectors, particularly the organic compounds known as amines and amine salts. These cationic collectors when dissolved in water give rise to hydrocarbon-chained ions that are positively charged. On the contrary, most flotation reagents, such as the xanthates, soaps and fatty acids give negatively charged hydrocarbon-chained ions.

Discussing the possibilities for developing new knowledge in this field, Professor A. M. Gaudin of the institute's department of metallurgy, who will direct the program, said that scientifically the new type of compounds are of extreme interest in that they will provide to some extent a behavior that is the opposite of that provided by the older type of reagents.

"The current rate of depletion of high- and medium-grade mineral resources the world over," said Professor Gaudin, "will impose on the engineer of the near future the burden of obtaining metals, non-metallic minerals and fuels from less and less favored raw materials. Flotation has become the key process in the recovery of minerals from lean ores. The research program sponsored by Armour & Company is aimed at an improved understanding of the fundamentals of the process and its more effective application."

Pennsylvania Anthracite Operation to Have Trial Run

Evan Evans, vice president and general manager of the Lehigh Navigation Coal Company, has announced that the company will operate the Nesquehoning Mine on a trial run until March. This mine was operated by the Edison Anthracite Coal Company on a lease from the Lehigh Navigation Coal Company from February, 1939, up until the expiration of the lease at the end of 1946.

Company officials told miners at the expiration of Edison operation that the firm is ". . . willing to operate the colliery at only a slight profit" but unless production is stepped up during the trial period the colliery breaker will be abandoned. Mr. Evans said, ". . . the future of the colliery depends upon the cooperation of every single worker."

Nesquehoning Colliery Local pledged full cooperation and voted to exercise every effort to make profitable operation of the mine possible.

Mine Crew Establishes Record

It is reported from Verdunville, W. Va., that, using only one motor, George Myers' crew at Mine No. 16 made a record performance on December 28, 1946, when they ran the greatest number of cars of coal that has been recorded by Island Creek Coal Company in the past six years for such a crew. According to Dave Hanshaw, mine foreman, "They sure broke the record for Mud Fork."

Members of this short crew are George Myers, foreman; Sammy Frye, Wayne Baisden, Robert Dingess, Kelly

MODERN MINE standardizes on BOWDIL

BITS, CHAINS and CUTTER BARS

WYOMING MINING CORPORATION
GENERAL OFFICES
LYNCO, WEST VIRGINIA

September 19, 1946

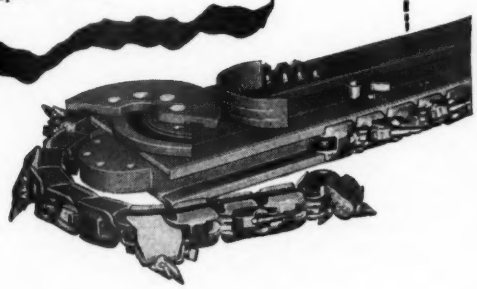
The Bowdil Company
Canton, Ohio

Attention: Mr. Charles Bowman

Dear Mr. Bowman:

We started using your bits about ten years ago and found them to be so satisfactory that we started to use your bars and chains, and the results have been such that we have standardized on them on all of our cutting machines.

Yours very truly,
Wyoming Mining Corporation
G. E. Minns
G. E. Minns, Superintendent



At Lynco, model mechanized mine of the Wyoming Mining Corporation, you find Bowdil equipment on all cutting machines. Here's why:

BOWDIL FABRI-FORGED CHAIN circles cutter bar at correct angle because of Bowdil's true running track guide. Drop-forged lug body stands up under heavy wear—is built for many times the normal load. Chain is easy to connect, remove or replace.

BOWDIL CUTTER BARS are specially made for coarse cutting. Built of high physical alloy steels, their rivet-free design gives them greater strength than conventional bars. They fit all types of machines.

BOWDIL CUTTER BITS save power — have 25% more wearing length—give 15% to 20% longer life.

Bowdil Equipment can help you increase mine efficiency and reduce operating costs. Get complete details. Write.

THE BOWDIL COMPANY
CANTON, OHIO

Helicopter Prospecting Anticipated

Hans T. Lundberg (left) takes a ride in a new helicopter intended for aerial prospecting

FULL-SCALE helicopter prospecting will get under way in Canada, the United States, Mexico and Venezuela this year as the result of experiments conducted with a Bell Aircraft Model 47 helicopter last summer in northern Ontario and Quebec, Hans T. Lundberg, vice president of Lundberg-Ryan Air Explorations, Inc., of New York and Toronto, Ont., has revealed.

Speaking at the meeting of the Canadian Institute of Mining Engineers at Ottawa, Canada, the well-known geophysicist said that, as a result of the tests, his organization will take delivery this month on the first of two specially-modified Bell helicopters and will start work immediately. "After many years of experimentation with airborne magnetometers using captive balloons, kites and airplanes," Lundberg told the engineers, "the best solution seemed to be the helicopter. Our aim has been to make magnetic surveys from the air that would closely duplicate the surveys made on the ground. The complete control of position with the helicopter makes this possible. A ground survey made in northern Quebec of an area 12,000 ft. by 10,000 ft. required about 70 days to prepare and to complete the magnetic operations utilizing the services of two engineers and two helpers," Lundberg explained. "Exactly the same area was surveyed by helicopter in one hour, using only an engineer-observer and a pilot." With the helicopter, it was found, flights very close to the ground could be made with complete safety. In bare areas, the engineers learned, surveys were made 25 and 50 ft. above the ground, while in forest areas the height was increased to 100 and 150 ft.

The information obtained during the summer involved the use of experimental equipment installed in a helicopter leased from Bell, Lundberg told the engineers, "and we expect even better results from the automatically-stabilized and continuous-recording equipment installed in the specially modified helicopter we will get this month."

New Zinc Company Formed in Baltimore

Zinc Chemical Co., Inc., a zinc chemical producing firm, has been formed jointly by The Glidden Co., International Minerals & Metals Corp., and the Phelps Dodge Refining Corp.

The new company, with Walter C. Bennett as president, will have executive and sales offices in New York City. The plant will be located at Baltimore, Md.

Various grades of zinc sulphate will be produced to meet increased demand for the product by the rayon industry principally, and by lithopone producers, zinc and lead producers, electro-galvanizers and glue manufacturers. The product also will be supplied to agricultural users for nutritional sprays for fruit trees.

Production will be under the direction of The Glidden Co. Phelps Dodge Refining will handle sales.

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When we talk about Whaley "Automat" service we mean complete service . . . a service that means loading any material, be it coal, rock or slate, at maximum production rates and doing it consistently.

The "Automat," with its natural shoveling action, is recognized by those who use it as unequaled in its field of operation for all around dependable service . . . for effective performance in the tough work. You don't have to "baby" an "Automat." Ask the man who uses it and he'll tell you—"If you want a loader that will load, in its stride, any lump of coal that will pass through your tipple, or any lump of rock, your cars, aerial tram or larries can take, and do it consistently, get a Whaley "Automat." Myers-Whaley Co., 227 Proctor, Knoxville 6, Tenn.

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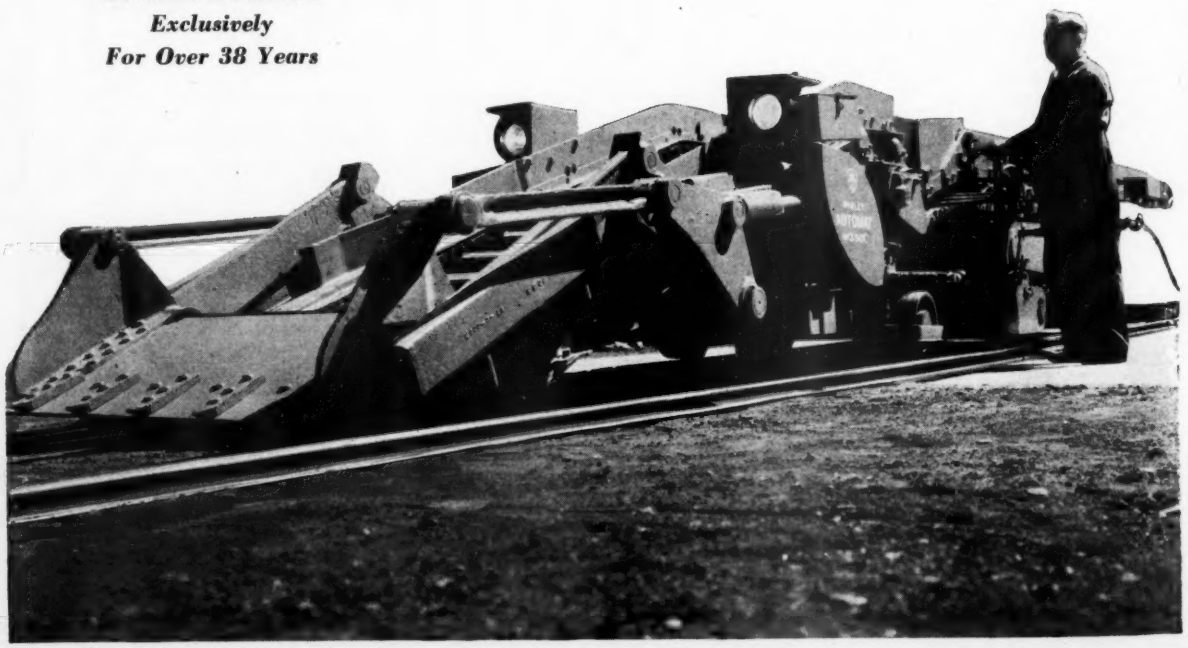


Spencer, Lloyd Walsh, Andy Curry, Sam Dalton, Carter T. Wilson, Carlos Wilson, and Abe Marcum.

Koppers Company Reviews 1946 Accomplishments

Substantial expansion of its new chemical division and vigorous activity in all of its engineering, construction, processing, manufacturing, research and sales operations were reported by Koppers Company, Inc., in a review of progress during 1946 issued in Pittsburgh recently.

Most outstanding growth during the year was in the chemical division which was established as a separate unit for the production of synthetic organic chemicals from coal. Completion of one new chemical plant, purchase of two WAA government properties and a specialty chemical company, and announcement of plans to build another new plant, were reported during the year by Dan M. Rugg, vice president of Koppers and general manager of its chemical division.

Five major projects of this division made known this year were (1) purchase of the styrene plant and other facilities at the big Koppers-operated government chemical plant at Kobuta, Pa., (2) completion of a phthalic anhydride plant at Kobuta with capacity of 7,600,000 lb. annually, (3) announcement of plans for construction of a polystyrene plant at Kobuta with capacity of 15 million lb. yearly, (4) negotiations for the purchase of WAA 100-octane gasoline refinery at Oil City, Pa., which, when the sale is consummated, will be converted for production of 10,000,000 lb. of synthetic organic chemicals yearly, and (5) purchase of the stock of the Pennsylvania Coal Products Company at Petrolia, Pa., which manufactures specialty synthetic organic chemicals.

Another expansion of Koppers manufacturing facilities was the purchase of a WAA plant adjacent to its American hammered piston ring division at Baltimore, Md. In addition to chrome plating and heat treating facilities, Koppers plans to add more equipment to increase production capacity of automotive and industrial piston rings.

The engineering and construction division received contracts for designing and building many new coke plants and auxiliary equipment. It also received contracts for repair and rehabilitation of numerous coke plants and batteries of ovens. At the end of the war many coke plants needed repairs and Koppers has been very active on contracts calling for rebuilding coke facilities. A large backlog of work has been booked by this division, including several South American contracts.

Central States

National Lead Company Acquire Texas Interests

The National Lead Company has acquired the mill and mining properties of the Texas Mining and Smelting Co., of Laredo, Tex., producers of antimony metal and antimony oxide. The purchase became effective as of the close of business December 31, 1946.

Earth's Temperature May Indicate Possible Ore Deposits

Taking of the earth's temperature may lead to discovery of valuable deposits of copper, lead, or zinc ores, a University of Michigan economic geologist has found. Speaking recently before student members of Sigma Gamma Epsilon, geology society, Dr. T. S. Lovering described some recent developments in methods of prospecting for metals. During the war Prof. Lovering was engaged in geological research for the government, and developed the use of "temperature gradients" as a method of locating ores.

Deposits of copper, zinc, and lead are usually surrounded by various sulfide compounds, Dr. Lovering explained, and as these sulfides "weather," they give off heat. The geologist searching for these ores may "take the temperature" of the earth in a given area, drilling holes in the ground or using existing mine tunnels to do so. If the temperature is above a given "normal," it may mean that sulfide bodies are near and therefore indicate presence of the desired ores of copper, zinc, and lead.

New Operations in Galena Field

On the Illinois side of the zinc mining belt, Tri-State Zinc, Inc., of Galena, is in production at the new Bautsch shaft which serves one of the newer discoveries in the district. It is located on the strike of the formation that produced the currently active Gray orebody, and the now mined-out Black Jack Mine, the latter the source of zinc ore for many years and a landmark in the mining history of Jo. Daviess County, Ill. The Tri-State firm is also hoisting from the two Gray shafts, and the combined production from these units places the firm in the lead as the largest producer in the Wisconsin-Illinois district at this time.

The Gill Mining Co. contemplates sinking a shaft on the Hahn property, two miles west of Galena on the White Rose mineral range. The firm has been drilling on the Henry Heller farm, six miles east of Galena.

The Eagle Picher Mining & Smelting Co., after acquiring leases north of Galena, has entered on an active drilling campaign for zinc.

New Zinc Operation Reported

The Consolidated Mining Company, located near Benton, Wis., is trucking crude zinc ore to the custom mill at Cuba City. This property is located near the Kittoe Mining Company, which is also producing zinc ore. The Meloy-Baker Company, also at Benton, is confining its operations to the Crawhall Mine at New Diggings. This ore is also trucked to the Cuba City plant.

Safety Meeting Held

The Lake Superior Mining Section of the National Safety Council held a mine safety meeting at the Ely, Minn., Community Center on January 23. William Jones of Ely and Clarence Hager were in charge of the arrangements. The Lake Superior Mine Safety Section plans to hold meetings each month on one of the iron ranges. The December meeting was held at Ishpeming, Mich., on the Marquette iron range.

Oliver Iron Plans Research Program

A long-range program of research, construction and expansion in the field of iron ore beneficiation entailing an expenditure of over $34,000,000 in the next six years, has been planned by the Oliver Iron Mining Company, according to R. T. Elstad, president of the U. S. Steel Corporation mining subsidiary. The first step in the program will be inaugurated this year by an expenditure of over $2,000,000 in the construction of two beneficiating plants.

Included in the plans are the construction of four additional beneficiation plants of varying size and capacity, to be located at various points on the Mesabi range; also additional facilities will be available at the company's research laboratory at Duluth.

The program covers not only the use of marginal and high silica ores, requiring the mining of many more tons of material and the use of more labor and equipment than in the case of direct shipping ores, but also the further reclamation of fine ores now being lost in tailings. Extensive fundamental research work on magnetic and non-magnetic taconites will begin this year, as an extension of the work done by Battelle Memorial Institute with which Oliver's research laboratory has been cooperating during the past three years.

Recently the Oliver Company established a new research laboratory at Duluth to continue and intensify its pioneering program of research in the general improvement of Lake Superior district iron ores used by the steelmaking facilities of the United States Steel Corporation. While the laboratory is not yet in full operation, it already has an annual payroll of over $100,000.

The plans disclosed late in January contemplate further steps in this long-range program conducted with a view toward increasing and conserving natural resources through the intelligent use of marginal ores and taconite, thus assuring an extension of the life of the mining industry in Minnesota for many years to come. In addition to the $34,000,000 program, the company is planning to make investments of over $6,000,000 in the development of underground mining properties,

which will provide more jobs for miners on the iron ranges.

Mr. Elstad pointed out, however, that in the completion of such a program the expenditures involved would be necessarily controlled by the amount of money available after taxes.

Ore Find Reported from Tri-State Area

Charles Roberts and associates are opening what appears to be a rich zinc-lead deposit on the old Robertson land, a 20-acre tract located just south of the Jasper-Newton county line. The site of the present mine was originally drilled last fall by Elmer Smith of Carterville and sinking operations started soon after. Ore was struck at a depth of 33 ft. in the shaft, which is now down to 45 ft. It has been reported that the last 3 ft. of ore will run about 35 percent in sphalerite recovery values and nearly 5 percent in galena. A drill rig was used in sinking the new shaft and a walking-beam pump has been installed to handle the water. Another pump of greater capacity will be installed in the old Want-More shaft, a short distance to the northeast, to drain the area. A hoisting derrick will be built and other equipment will be installed to open up the new mine. Old-timers in the district will remember the Want-More shaft as that opened in 1911 by the Columbia Mining Company and last operated in 1918.

Deal Closed on Iron Mine

Pickands, Mather & Company on January 1, 1947, officially acquired the Davidson iron mine from the Pittsburgh Coke & Chemical Co., Iron River, Mich., and placed it under the new mining subsidiary, Pickands Mining Co. H. J. Richards, Caspian, Mich., general superintendent for Pickands, Mather & Company, on the Menominee iron range, will have jurisdiction over the Davidson mine, along with other iron mines of Pickands, Mather & Company.

Lucky Jenny Mill Nearly Ready for Operation

Harris Mining Company is completing the reconditioning of the old Lucky Jenny Mill at Hockerville, Okla., and is expected to start milling operations this month. Loren Keenan of Baxter Springs heads the company, which has been engaged on a program of general repairs, overhauling of old equipment, and the installation of new. The mill will have a capacity of about 25 tons an hour. The equipment includes that of a regular type Joplin mill with flotation machines and it is planned to increase

the capacity later with the installation of a large crusher.

This mill will treat ore from the Lucky Jack Mine and three properties operated by the Harris company—the Baird mines on the Douthat land south of Cardin, the old Evans-Wallower No. 24 lease northeast of Picher in Kansas, and the Silver Fox Mine northwest of Treece.

The old Guaranty Mining and Royalty Co. and Charles Barnett of Joplin formerly operated the mill. During the early part of the war the operation was under the name of the Mutual Mining and Development Co.

Airborne Magnetometer Survey Being Made

A twin-engine Beechcraft plane is flying a magnetometer survey in southwest Missouri in Bonne Terre area. The survey is being conducted by the U. S. Geological Survey, which is traversing the region at quarter-mile intervals. The equipment will be moved to the Tri-State area for similar exploration as soon as the Bonne Terre traverse is completed.

Olivene Deposit Being Quarried

Harbison & Walker Refractories Company, of Pittsburgh, is purchasing olivenite ore, a form of copper arsenate used in making refractory brick, from deposits of the ore in western Washington. United Recovery Company, of Seattle, associated with H. P. Scheel, is quarrying the ore for Harbison from Skagit County deposits.

Strikes Reduce Indiana Coal Production

Coal production in Indiana in 1946 amounted to 22 million tons, according to estimated figures released by the Coal Trade Association of Indiana. This amount is two and one-half million tons less than the total of 1945 and six million tons less than 1944. It is comparable to 1941, when 22,484,000 tons were produced.

"Indiana's loss in tonnage in 1946 was due practically entirely to strikes which eliminated production or affected the mines during nine weeks of the year," stated C. C. Lydick, managing director of the Coal Trade Association. "If it had not been for the strikes in April, May, November and December, the state's production would no doubt have exceeded that of 1945 and the current low stockpiles would not exist among the large consumers of Indiana coal." December production amounted to 1,849,500 tons as compared to 2,300,000 tons in December, 1945, and 2,480,000 tons in December, 1944.

State Mine Report Available

The 28th annual report of the Coal Mine Inspection Department for North Dakota has been published. This report is a valuable reference to those interested in coal operations in the state, as it contains a complete list of coal mines, their location, tonnages produced and shipped, and a statement as to the type of mining at each operation. The names and addresses of the mine superintendents are also listed. Accident data are included with safety records for the various operations and comments on the type of injury received. The report embraces a period from July 1, 1945, to June 30, 1946.

Marcia K. Reopens Old Shaft

Preparations are being made by the Marcia K. Mining Company to reopen the Birthday mill shaft, northwest of the company's old Lawyers' mill, southeast of Picher, Okla. The company reopened a field shaft some time ago on the Birthday tract, and has expanded considerably its mining and milling operations on the old Lawyers property since taking it over more than a year ago. The Birthday mill shaft was last operated more than 15 years ago when the mill on the site was destroyed by fire. The shaft is being recribbed and a 300-ton

wooden hopper and derrick has been acquired from the Davis-Big Chief Mining Company and will be moved to the mine site. Mine operations will be carried on at the lower level at a depth of around 235 feet. Among those associated in the company are Claude Jones, Louis J. Bowers, Dr. M. A. Connell and Floyd Bumgarner.

Wheels of Government

(*Continued from page* 114)

ascertainment of the proper amount of overtime work to be compensated for rather than as a denial or contest of the fact of liability or the fundamental basis of computation." Nothing is said about cases where the statute of limitation may have run.

Coal Situation

The Government-Lewis-UMWA case was argued before the Supreme Court January 14. The Attorney General urged the court to uphold the action of the lower courts, including the $3,510,000 fine imposed on Lewis and the UMWA for contempt. It was submitted to the court that the Government is seeking: (1) Ratification of its right and authority to operate the coal mines under war powers and statutes; (2) vindication of the power of the Federal courts to "prevent irreparable injury to the people of the nation"; and (3) prevention of interference with the sovereign functions of the Government.

UMWA attorneys argued to show that Congress had not intended that the Norris-LaGuardia Act should not embrace the Government, hence barring the Government from the use of the injunction. They also repeated the argument that the lower court action in issuing the restraining order and injunction was in violation of the First and Thirteenth Amendments to the Constitution. Another of their arguments was that even if the court decided that the Norris-LaGuardia Act did not apply to the Government, such a ruling would not be applicable in the current case, "since operation of the mines under the Smith-Connally Act is not actual bona fide Government operation."

No decision is expected to issue from the Supreme Court before February 10.

Premium Metal Payments

Effective January 27, OWMR Commissioner Harold Stein was given direction of the reorganized operations of the Premium Price Plan for copper, lead and zinc. Stein has appointed Clarence O. Mittendorf as director for the plan, with a consolidated staff made up of former CPA and OPA men who have worked on the program. The director will recommend assignment of new quotas and revisions in existing quotas to a review board composed of representatives of CPA, RFC and OPA; Commissioner Stein has stated that all administrative regulations and procedures for administration of the plan will continue in effect and will be published in the *Federal Register*.

Meanwhile, Representatives Allen (Rep., Ill.) and Russell (Rep., Nev.) have introduced bills providing for a National Minerals Resources Division in the Department of Interior to take over the Premium Price Plan and to administer a system of "development and conservation payments." The Russell bill would place purchased materials in the national stockpiles provided for by the 1946 Stockpile Act, while under the Allen bill, payments for any particular metals and minerals would be in addition to the market price, and the producer would ordinarily sell his products to industry in the normal manner. In both bills disbursements are authorized up to $100 million per year.

Western States

Boise River to be Dredged

A new precedent has been set in Idaho by the granting of permission for gold dredging operations on the Boise River to Leverett Davis, mining engineer, by the State Land Board over the objections of many Boise River water users. The board granted the lease by 4 to 1.

Farmers along the river vigorously opposed granting the lease on their contention that the operations would increase the silt and sand moving downstream into the irrigation canals.

Among the new provisions, establishing an innovation in state river bed leases, are these provisions:

1. Davis must post $100,000 performance bond "running to the benefit of the state and water users of Boise Valley" and guaranteeing that he will abide by the lease and keep the river in the same condition as at present.

2. The lease is subject to cancellation on 30 days' notice if the sand conditions are aggravated by Davis' operations.

3. The lessee "agrees at his own expense to operate a suction-type sand dredger for the purpose of taking from the bed of the river all sand which shall come downstream."

February Meeting of Miners and Prospectors Association

Plans have been completed for the 1947 annual meeting of the New Mexico Miners and Prospectors Association at Albuquerque, February 21-22. President E. C. Iden will preside, making his annual report of 1946 association activities, with a report by Executive Secretary Jack C. Pierce of a well-planned program for 1947. Attendance of mining men is expected to set a new record.

State Production Shows Decrease for 1946

New Mexico mines produced in 1946 a total of $37,918,965.46 in minerals, according to the annual report of State Inspector of Mines Warren Bracewell, submitted at the end of the year. This total production showed a decrease from 1945, when value of all minerals was $48,824,267. The decrease was in copper, zinc, manganese and coal, and was attributable to readjustments following end of the war and a continued serious shortage of labor.

Mining Association Elects Officers

A. V. Taylor, Jr., of Philipsburg, was elected president of the Mining Association of Montana as the small mine operators of the state opened their seventh biennial legislative meeting at the Placer Hotel on January 23. Taylor, who is president of the Taylor-Knapp company, succeeds Robert P. Porter, of Helena. Others elected were Gailen T. Vandel, of Helena, chief mining engineer for Porter Brothers Corporation and president of the Last Chance Gulch Mining Association, first vice president; R. B. Shellady, of Garrison, president and general manager of the Montana Phosphate Products company, second vice president, and Carl J. Trauerman, of Butte, president of the Butte Copper Consolidated Mines, re-elected secretary-treasurer.

Dr. Francis A. Thomson, president of the Montana School of Mines in Butte and director of the Montana Bureau of Mines and Geology, was re-elected chairman of the executive committee.

Mine to be Re-equipped

Rehabilitation of the Consolidated Eureka Mining property (formerly called Diamond-Excelsior Consolidated Mining Company), at Eureka, Nev., is planned, according to James E. Hogle, of Salt Lake City, president. The program calls for the expenditure of $150,000 in re-equipping the mine and for a diamond drilling and development program. During the past few years considerable drilling and geophysical work has been conducted at the property under the direction of the Bureau of Mines. Plans for financing are now under way.

Capacity of Power Plant to be Doubled

Utah Copper division of Kennecott Copper Corporation announces that the capacity of the company's new electric power plant will be doubled as fast as materials become available. Up to the present time the company has been drawing about half of its power needs from the Utah Power & Light Company. The first unit of the copper company's power plant was completed and placed in operation just prior to the war.

—Washington *Daily News.*

"I cut my finger on the edge of a page in your safety booklet"

New Shaft Encounters Values

Good showings of mineralization have been encountered at a shallow depth in the new shaft now being sunk by Great Western Exploration Co., in the Starlight Vein of the Arizona Magma Mine near Chloride, Ariz. This mine was acquired by Great Western Exploration Co. under bond and lease in 1945 and according to Nye A. Wimer, president, the company plans to sink the new shaft to a depth of not less than 200 ft. following the dip of the Starlight Vein.

The last operation of the Arizona Magma was from 1934 to 1940 during which time some 90,000 tons of ore were mined from the Magma Vein some 750 ft. to the south of the location of the shaft being sunk at present by Great Western Exploration Co. Most of this ore, which had a gross value of approximately one million dollars, was extracted from above the 200-ft. level in the Magma Vein. The values carried in the ore mined from the Magma Vein were principally high-grade silver with some gold. Mr. Wimer who is also president of Tennessee Schuylkill Corporation, stated that ore found in the Starlight Vein could be milled at the 150-ton concentrator at the Tennessee Mine some two miles distant from the Arizona Magma.

Thomas L. Chapman, mining engineer and geologist, of Chloride, Ariz., is in charge of the work at the Arizona Magma.

Western Mining Association Elects Officers

F. I. Bristol, of Grants Pass, president of the Bristol Silica company at Rogue River, is the new president of the Oregon Mining Association. The first Grants Pass man to head that body which consists of the state's mining operators, he was elected at a meeting in Portland, late in December. W. Frank Murry, also of Grants Pass, manager of the Pacific Portland Cement company at Gold Hill, was elected a director. Bristol replaces S. H. Williston, head of two large quicksilver mining organizations, who continues as vice president and a director. The secretary is State Senator Irving Rand, of Portland.

Old Property Being Reopened

The Silver Star-Queens Mine in southern Idaho, near Hailey, is being reopened for production. It is stated that the mine produced several million dollars' worth of lead-silver-zinc ore in the 1890's by shipping crude hand-sorted ore to the smelters. The rejects were left in a stockpile which is said to represent a large tonnage of commercial ore.

Exposition Slated in March for San Francisco Bay Area

Many scientists, mining and metallurgical engineers are expected to attend the fifth Western Metal Congress and Exposition at Oakland this March. Two Oakland Civic Auditoriums will be used for exhibits during the six days beginning on March 22. W. H. Eisenman, managing director of this exposition, is also national secretary of the American Society of Metals.

Mining Activity Increases at Leadville

New activity is predicted for the 1947 season at Leadville, Colo. The American Smelting and Refining Company has improved its two mills and has been treating approximately 250 tons of ore daily. Most of the tonnage has come from the company's properties at Kokomo. It is understood that A. S. & R. is planning to expand its exploratory program in 1947 to include work in the old Garibaldi shaft at the head of California Gulch and properties on Carbonate and Fryer Hills.

The Resurrection Mining Company announced that it produced in 1946

some 65,000 tons of lead-zinc ore and milled more than 35,000 tons of custom ore.

The Hamm Mining and Milling Company may rehabilitate its gold recovery plant, according to General Manager John Hamm. The Ibex Mine also reported production of 250 tons of gold, lead and zinc ore per month.

Cripple Creek Shows Increased Gold Production for 1946

Gold ore from this famous Colorado district valued at $1,873,998.82 was treated at the Golden Cycle Mill in Colorado Springs during 1946. Ore from the district was valued at $1,100,000 in 1945. Last year's tonnage from Cripple Creek mines was 299,647, an increase of 170,174 over the 1945 figure of 129,500. The Golden Cycle Mill also treated 7,192 tons of ore from other districts in Colorado, boosting the mill's total last year to 306,839 tons. Mining operators reported that the manpower shortage, although less acute than a year ago, still prevents more extensive operations but they expect 1947 will bring more normal conditions.

Shipments from the Ajax Mine last year were the most valuable of any property in the district. Values were exceptionally good on the two bottom levels. In December one 41-ton car was shipped, which settled at $457 a ton, and another 40-ton car brought $143 a ton. Earlier a car was shipped which ran 13 ounces to the ton and another ran 10.665 ounces a ton. Superintendent Earl Bebee of the Ajax reported six sets of lessees are operating in the mine.

Exploration to Begin on New Claims

Continuing a comprehensive expansion program, East Standard Mining Company recently acquired an additional group of mining claims, located 12 miles from Prescott, Ariz. The property is opened by two shallow shafts and it is anticipated that the company will begin exploration work in the near future. In the meantime, work is progressing at a new locality near Eureka, Nev. Here six claims were purchased recently by the company and development work has started.

Mill Completed

Installation of a new mill with a capacity of 25 tons of ore per day has been completed at the Grit gold mine in the Greenwood district, northwest of historic Spanish Dry Diggings not far from Placerville, Calif. Frank M. Hinton and Joseph L. Liddicoat, new owners of the property, report that production is expected to start soon.

Ore Output to be Speeded at North Butte Property

The North Butte Mining Company at Butte, Mont., the only large independent operating mining company in the Butte district, has recently resumed mining operations on its properties through its Granite Mountain shaft. Work is progressing on the old Toulumne shaft which will be opened in the near future.

This property has not operated to any extent since 1930, when it was shut down during the depression. At the outbreak of the recent war a one-million-dollar loan was obtained from the U. S. Government to resume mining operations. To expedite quick removal of copper ores for the war effort, a working agreement was reached between the North Butte Mining Company, the U. S. Government and the Anaconda Copper Mining Company, whereby the Anaconda operated and mined North Butte property through the Badger State Mine.

Since then, North Butte has done considerable development work, especially in the Granite Mountain shaft, where new stations have been cut

from the 2,800-ft. to the 3,600-ft. levels at 200-ft. intervals. Large bodies of rich copper ore have been blocked out in this area.

Fire Destroys Laboratory and Offices

A disastrous fire of undetermined origin completely razed the shops, offices and laboratory of the American Zinc, Lead and Smelting Company at its mill near Ouray, Colo. Expensive equipment was destroyed and although the loss is covered by insurance, replacement will be difficult at the present time. Manager John Bowsher stated that the mill was untouched but the fire will greatly inconvenience operations and slow down production.

Gold King Mine to Start Its Mill

A new 100-ton flotation mill will soon be in operation at the Gold King Mine, 26 miles southeast of Kingman, Ariz. It will start on a 10,000-ton dump of gold-silver ore, accumulated since the Moss Canyon Mining and Milling Company took over the property last October.

This ore was stoped from a new tunnel, and the stoping caused serious caving. Now a new working shaft is being sunk, with the intention of cross-cutting the known ore bodies.

Unusual Shaft Sinking Record

Polaris Mining Company has established a record for shaft sinking in the Coeur d'Alene district in Idaho, completing the 3-compartment Silver Summit shaft, 1,545 ft., in 11 months and 8 days, averaging around 140 ft. per month. The largest footage completed in any one month was 204¾ ft. in September. This record was made possible through use of the Riddell mucking machine, consisting of a clamshell digging bucket, the operation of which has been explained in THE MINING CONGRESS JOURNAL. The Silver Summit shaft is now 3,000 ft. deep and Polaris is now driving a crosscut from this level to prospect the Chester vein system at the geological horizon in which the Sunshine Mining Company has opened rich ore bodies in the same vein system some 5,000 feet further west.

Gold Property to Have New Mill

For several months development work has been going forward on a new shaft at the Miners Gold property at Midas, Nev. The shaft was sunk on the vein with gold and silver content satisfactory. It is the intention of the lessee, Charles Kassabaum, to build a mill as soon as possible in the spring. Machinery and lumber have been purchased for construction.

North Star Mine to be Opened for Leasing

The Empire Star Mining Company has announced that leasing operations are being resumed in the North Star Mine at Grass Valley, Calif. A spokesman for the company said leasers will be permitted to operate in the No. 5 winze of the North Star.

At present it is contemplated three groups of leasers, eight miners to the group, will be given contracts in the No. 5, the deepest winze in the mine, which when mining was suspended last July was at the 11,000-ft. level on the incline, approximately 5,500 ft. vertical depth.

The leases are in the process of being written. It was stated that leases in the North Star do not foreshadow, for the present at any rate, leasing operations in the Empire or Pennsylvania Mines. Since the Empire, North Star and Pennsylvania were closed in July they have been maintained and kept in an operative condition.

The news that leases will be made in the North Star was hailed with much satisfaction, since many of the larger properties were developed into profitable mines by tributers who shared with the owners in the profits.

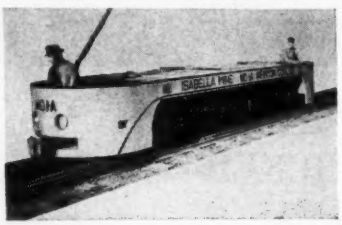
MANUFACTURERS FORUM

General Electric Announces New 25-Ton High-speed Electric Mine Haulage Locomotive

A new 25-ton, 480-hp. high-speed electric mine haulage locomotive designed especially for heavy, fast haulage over long runs has been announced by the Transportation Divisions of the General Electric Company.

The first of these special mine locomotives has been placed in operation at the Weirton Coal Company's Isabella mine in Pennsylvania.

This locomotive is of all welded steel construction and its top maximum speed of 40 mph, makes it very desirable for use where the distance from the gathering point to the tipple is 5 miles or more, since its inherent speed

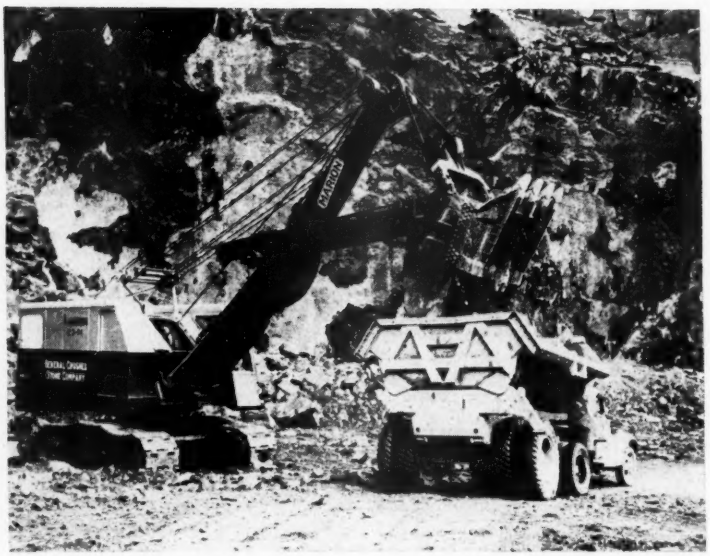


and power reduces the time required to get coal out and return the empties to the working face.

The locomotive has two 2-axle swivel trucks providing four-axle distribution of locomotive weight to reduce load and lateral force wear on trackage. The short rigid-wheelbase trucks, with low inertia and swivel connection to the frame, allow free wheel tracking, and minimize binding and strain on both locomotive and rails. Short end overhang in relation to distance between body support points prevents teetering or galloping at high speed.

Each axle is driven by a 120-hp., 250-volt heavy-duty traction motor with frames of modern rigid one-piece box-type construction. Sparkless commutation over the entire range of load conditions assures long brush life and low commutator maintenance. Motor-powered blowers provide complete traction motor ventilation.

At the continuous rating of the traction motors, the locomotive develops 12,500 lb. tractive effort which is equivalent to 25 per cent adhesion. The rated drawbar pull is 12,500 lb. at a speed of 11.5 miles per hour.



Marion Introduces the 93-M

Marion Power Shovel Company, of Marion, Ohio, is formally presenting the Marion 93-M, a heavy-duty, all-purpose shovel, dragline, clamshell and crane. It is one of three new Marions since V-J Day.

The Marion 93-M is a full-rated 2½ cu. yd. machine designed for mining, quarrying and large-scale construction projects, particularly those involving ore and rock.

Features of the new machine include Marion air control, case of convertibility to dragline, clamshell and crane service, ease of preparation for railroad shipment, simplicity and accessibility of all machinery and moving parts, careful proportioning of rugged construction and ample power for heavy-duty service.

Shovel front-end equipment includes an all-welded, rounded-edge, box section boom, twin welded full box section dipper handles and a heavy duty manganese-steel-front dipper with inserted socket-type dipper teeth.

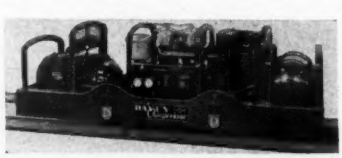
For dragline or clamshell service, varying boom lengths and bucket combinations are available as job conditions may require.

A live boom hoist is standard equipment, making the machine particularly adaptable for crane service.

New Railcar Compressor for Mine and Tunnel Work

Production of a new railcar compressor for mine and tunnel work is announced by Davey Compressor Co., Kent, Ohio. Mounted on a welded structural steel chassis, the unit is available in 60, 105, 160, 210, 315 c.f.m. capacities.

The two-stage compressor is directly connected to a gasoline engine, Diesel engine or electric motor—in accordance with the purchaser's preference. Gas and Diesel machines include a throttle control and unloader



which automatically regulate pressure and acceleration. Electrically-driven units have automatic controls and explosion-proof electrical equipment.

Standard equipment includes heavy metal canopy with open sides and doors for ready access and ventilation. Tool box and kit are included.

Le Roi Buys Cleveland Rock Drill Company

Le Roi Company, Milwaukee, Wis., announces the purchase of the Cleveland Rock Drill Company, of Cleveland, Ohio.

The purchase of this company, a division of The Cleveland Pneumatic Tool Company, substantially accelerates the rock drill manufacturing program announced earlier, coincidental with the establishment of Le Roi's Cleveland Division. Russ Morgan, formerly secretary and sales manager of The Cleveland Rock Drill Company, who joined Le Roi over a year ago and who was instrumental in the organization of Le Roi's Cleveland Division, will head the expanded facilities.

The Le Roi-Cleveland product line in current production includes a complete series of rock drills, including light, medium, and heavy hand-held machines, both hand and power-feed drifters, two types of stopers, and a universal wagon drill. A wide range of paving breaker models, two types of spaders, a back fill tamper and a related line of accessories complete the present line.

New M.S.A. Speedframe

The M.S.A. Speedframe, a self-adjusting welders' goggle which eliminates the waste motion and time of tiresome hand adjustment of goggles is made by Mine Safety Appliances Company, Pittsburgh.

A nod of the head raises or lowers the goggles instantly, leaving both hands free for handling of work. The Speedframe consists of suitable goggles mounted in a lightweight fiber headframe of headline design which holds the goggles securely in either position without uncomfortable pressure on temples or bridge of nose. It is made fully-adjustable in three directions by side and top straps and is held in desired position by a simple screw-type clamp. The M.S.A. Speedframe can be furnished with welders' or chippers' goggles—with or without Coverglas lenses, as desired.

A copy of Bulletin No. CE-7 describes this goggle and will be sent upon request to the company.

— *Announcements* —

Sauerman Bros., Inc., Chicago, announces the appointment of **Martin Meyer** as assistant sales manager. This gives D. D. Guilfoil, general sales manager, much needed aid in handling a rapidly expanding market. Mr. Meyer has been engaged in both the sale and engineering of Sauerman scrapers and cableways for the last six years and previously was in railroad construction work.

* * *

Election of **Harvey T. Gracely** as president and general manager of **Marion Power Shovel Company** has been announced by E. G. Diefenbach, of New York City, chairman of the board. He succeeds M. E. Montrose.

Harvey T. Gracely

Mr. Gracely assumed his new duties immediately upon his election at a meeting of the board in New York January 6. He brings to his new position a wide background of engineering and selling in the power shovel industry and a broad acquaintance in the industries served by the company.

* * *

A. T. Cowan, of Pittsburg, Kans., has been appointed general manager of **Morrow Mfg. Co.**, Wellston, Ohio, a subsidiary of **McNally Pittsburg Mfg. Corp.** Mr. Cowan succeeds Frank C. Morrow, who with Ford R. Morrow, will retire from management of the firm. He was formerly chief estimating engineer for McNally Pittsburg at Pittsburg, Kans.

* * *

Kennametal, Inc., Latrobe, Pa., announces the appointment of two representatives to sell and service Kennametal mining tools in the states of West Virginia, Virginia and Kentucky. **Frank R. Klesyk**, whose address is Box 201, Blairsville, Pa., will cover an area in West Virginia comprising the following counties — Barbour, Grant, Marion, Preston, Upshur, Braxton, Hancock, Mineral, Randolph, Webster, Brooke, Harrison, Monongalia, Taylor, Gilmer, Lewis, Ohio, Tucker, Boone, Kanawha, Nicholas, Cabell, Clay, Lincoln, Putnam, Fayette, Logan, Wayne, Greenbrier, Mason and Raleigh.

D. L. Tunsberg, 218 Wallace Street, Princeton, W. Va., will cover Mercer, McDowell, Mingo and Wyoming counties in West Virginia; Buchanan, Russell, Dickenson, Scott, Lee, Tazewell, Montgomery and Wise counties in Virginia; Bell, Johnson, Martin, Whitley, Clay, Knott, McCreary, Knox, Floyd, Leslie, Perry, Harlan, Letcher and Pike counties in Kentucky.

* * *

Dr. William Parks Yant, director of research, **Mine Safety Appliances Company**, and internationally known for research in safety and health, was chosen the 1946 recipient of the Pittsburgh Award, bestowed annually by the Pittsburgh Section of the American Chemical Society for outstanding service to chemistry.

"Dr. Yant has contributed prolifically to science, industry and welfare" said the announcement by Dean Herbert E. Longenecker of the Graduate School of the University of Pittsburgh, chairman of the section. "Every activity of his has directly benefitted humanity by improving health, reducing suffering, and raising the general economic level."

In 1919 he joined the U. S. Bureau of Mines. During this association, he earned an international reputation for his knowledge of safety and for his vigorous researches.

* * *

Curran Cavanagh, who has been district manager of Cardox Corporation of Library, Pa., has resigned as of February 1 and is now vice president of **Fairmont Supply Company** of Fairmont, W. Va., a jobber in mine and mill supplies covering northern West Virginia and adjacent territory. Mr. Cavanagh, in assuming his new duties, will make his headquarters in Fairmont. **Z. B. Hampton**, vice president of Fairmont Supply Co., is retiring April 1.

Curran Cavanagh

* * *

Announcement is made of the appointment of **Leonard E. Matzner** as advertising manager for **Mack Manufacturing Corporation.** Mr. Matzner had been serving the company in the capacity of assistant advertising manager following his return from active duty in the Pacific Theatre of Operations.

Leonard E. Matzner

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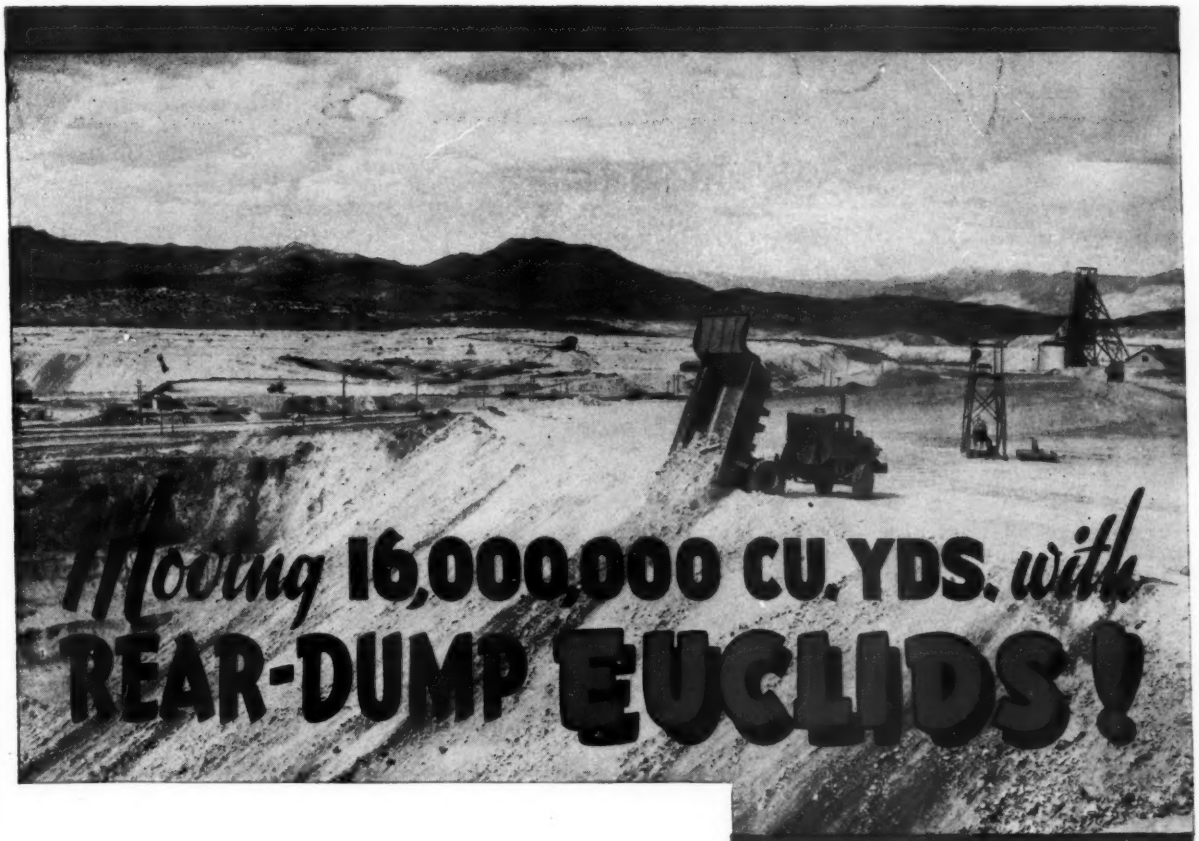


Moving 16,000,000 CU. YDS. with REAR-DUMP EUCLIDS!

The Isbell Construction Co. of Reno, Nevada is moving about 30,000 tons of overburden every working day of fifteen hours at this big open pit operation for one of the large copper producers in eastern Nevada.

Loaded by 2½ cu. yd. shovels, 23 Rear-Dump Euclids carry full 15-ton loads on hauls up to one mile in length. Working at an altitude of approximately 7,000 ft. the Euclids have plenty of power and speed for the long hauls and maximum adverse grades of 8%.

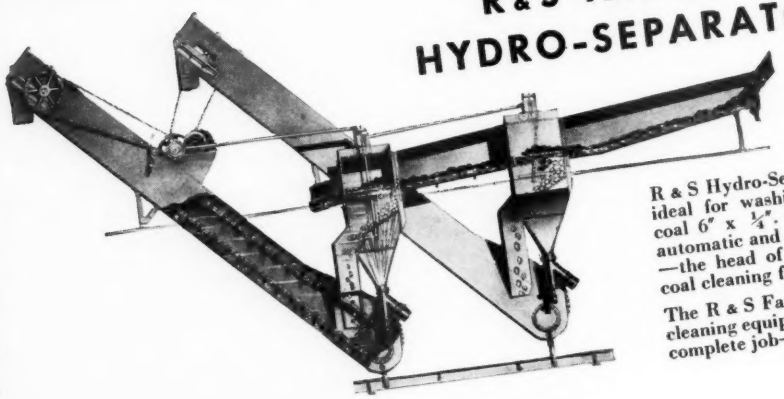
A leading contractor in the West, Isbell Construction purchased 10 Rear-Dumps of 15-ton capacity in 1943 and now has a total of 23 Euclids. Coming from men who know equipment and use it on the toughest jobs, these repeat orders are evidence of the efficient and reliable performance that is built into every Euclid.

Write for facts and figures on what Euclids can do for you on present or future work.

The EUCLID ROAD MACHINERY Co.
CLEVELAND 17, OHIO

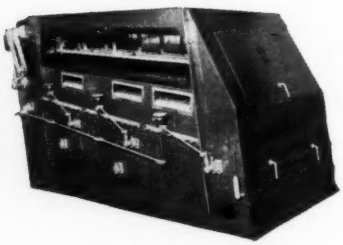
THE FIRST FAMILY
OF COAL CLEANING EQUIPMENT

R&S TANDEM HYDRO-SEPARATOR



R & S Hydro-Separator is ideal for washing coarse coal 6" x ¼". It is fully automatic and continuous —the head of the R & S coal cleaning family.

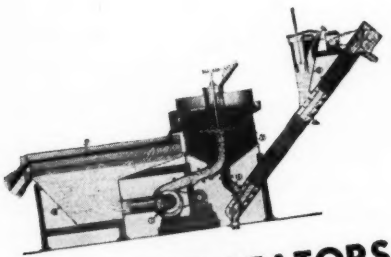
The R & S Family of coal cleaning equipment does a complete job—a good job.



R&S STUMP AIR FLOW CLEANER

R & S Stump Air Flow Cleaner is a highly efficient unit where dry cleaning of coal is desirable and the coal amenable to this process.

The R & S Family of coal cleaning equipment does a complete job—a good job.



R&S HYDROTATORS

R & S Hydrotator process for smaller coal sizes ¼" x 0" in combination with the Hydro-Separator above forms a complete cleaning plant . . . promotes total low cost mechanization underground.

ROBERTS and SCHAEFER CO.

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